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LIFE CYCLE COST PROCUREMENT GUIDE,(U)
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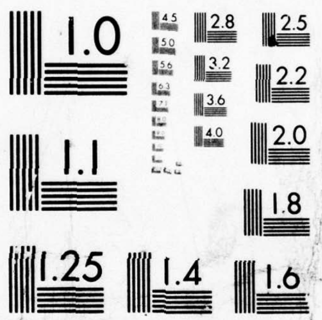

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Life Cycle Cost Procurement Guide

JULY 1976

JOINT AFSC/AFLC COMMANDERS'
WORKING GROUP ON LIFE CYCLE COST
ASD/ACL
WPAFB, OHIO 45433

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LIFE CYCLE COST PROCUREMENT GUIDE

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Preface

This document addresses the application of life cycle cost procurement techniques in the acquisition of systems, subsystems and equipments. The primary purpose of this document is to provide program managers and procurement personnel with an overall understanding of all aspects of life cycle cost procurement and detailed discussions of many important activities and considerations required to execute life cycle cost procurements.

This document is intended to be used in conjunction with existing policies. If it is found inconsistent with official guidance, regulations or directives, the provisions of the official directives apply. Comments on and suggestions for improving this document are solicited and should be submitted to ASD/ACL, Wright-Patterson AFB, Ohio 45433.

This document has been reviewed and approved.

John DS Gibson

JOHN D. S. GIBSON, Director
AFSC/AFLC LCC Working Group
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Contents

Chapter 1

Introduction

1-1 Life Cycle Cost Procurement Policy

The evolution of the life cycle costing (LCC) concept in DoD began in the early 1960's, primarily because of increasing concern over the consequences of competitive procurement without regard to total cost, i.e., life cycle cost. The objective of life cycle costing is to consider ownership costs, e.g., operation, maintenance and support costs as well as development and acquisition costs, in order to assess the economic implications of various design development options and acquisition decisions. This principle, with respect to the use of LCC in contract awards, was recognized in the Armed Services Procurement Act of 1947 which states, "Award shall be made . . . to the responsible bidder whose bid . . . will be most advantageous to the United States, price and other factors considered." Furthermore, the Armed Services Procurement Regulation (ASPR) states, "It is the policy of the Department of Defense to procure supplies from responsible sources at fair and reasonable prices calculated to result in the lowest ultimate overall cost to the Government."

Defense Procurement Circular #115, dated 24 September 1973, added a section on life cycle costing to the ASPR (Section 1-335). This section states:

> "Since the cost of operating and supporting the system or equipment for its useful life is substantial and, in many cases, greater than the acquisition cost, it is essential that such costs be considered in development and acquisition decisions in order that proper consideration can be given to those systems or equipments that will result in the lowest life cycle cost to the Government."

Life cycle costing and design to cost are keystones in the DoD management strategy to control the increasing costs of defense systems. The design to cost concept is goal oriented, utilizing cost as a "design to" requirement. These cost goals are established for measurable cost elements, such as average unit flyaway cost and production unit cost; or for measurable cost driving parameters, such as reliability and maintainability; or portions of operating and support costs, such as manpower, support equipment and spares. Life cycle costing is the consideration of life cycle cost in various decisions associated with developing, acquiring, maintaining, modifying or replacing an item or equipment. As such, life cycle costing can be used in assessing most decisions, including the establishment and adjustment of design to cost goals. Acquisition costs have risen

steadily, due to inflation and the higher cost of buying more complex systems. Operating and support costs have also increased primarily due to the increasing cost of personnel. The DoD introduced the design to cost concept in 1971 for major system acquisitions. A key program consideration stated in DoD Directive 5000.1 is:

"Cost parameters shall be established which consider the cost of acquisition and ownership; discrete cost elements (e.g., unit production cost, operating and support cost) shall be translated into "design to cost" requirements. System development shall be continuously evaluated against these requirements with the same rigor as that applied to technical requirements. Practical tradeoffs shall be made between system capability, cost and schedule. Traceability of estimates and costing factors, including those for economic escalation, shall be maintained."

The design to cost concept has been further elaborated and developed in DoD Directive 5000.28, "Design-to-Cost," 23 May 1975. It also clearly states that the "design to" approach will specifically include life cycle costing to the greatest extent possible. This requirement is covered in AF Regulation 800-11, "Life Cycle Costing," 3 August 1973, which includes the explanation of the Air Force policy on life cycle costing.

"The Air Force will, to the maximum practical extent, determine and consider life cycle cost in various decisions associated with the development, acquisition and modification of defense systems and subsystems and in the procurement of components and parts. For a system or subsystem undergoing development or modification, the decisions in which life cycle cost can be used include: design choices, selection of a source(s); evaluation of engineering change proposals; and determinations on whether or not to proceed to subsequent acquisition phases. The specific method of LCC application will depend upon the acquisition strategy and related decision processes. The rationale for the nonuse of LCC will be provided in the Advanced Procurement Plan (APP) for the specific application. For a component or part procured on a fixed price basis, the decisions in which life cycle cost can be used include that of selecting a production source. If the procuring activity does not apply life cycle cost, it must show that such application would not be of benefit to the Air Force. Particular emphasis will be placed on those items which have a high ownership cost."

1-2 Purpose

The overall process of effectively implementing life cycle cost procurement procedures involves many activities, over a long period of time. Activities that usually must be accomplished to effectively apply life cycle cost procurement procedures include:

a. Gaining an understanding of the system or equipment and important aspects of its design, planned use and support requirements.

b. Identifying important program constraints which might bear on the successful application of LCC procurement procedures.

c. Determining if any aspect of LCC procurement is appropriate for the program.

d. Determining if use of LCC incentive provisions are appropriate for the program.

e. Selecting the best LCC procurement strategy.

f. Tailoring the LCC procurement startegy and approach to the specific program.

g. Planning in detail the required LCC procurement implementation actions.

h. Preparing the required contract documentation.

i. Continually monitoring and managing the required implementation actions.

The purpose of this document is to provide guidance to program managers and procurement personnel, especially contracting officers, on the utilization of life cycle cost procurement techniques in the acquisition of systems, subsystems and equipment.

1-3 Scope

The material contained in this document is ordered to logically lead the reader through the subject matter. Chapters 1 and 2 provide a general understanding of life cycle cost procurement. The remainder of the guide consists of more detailed discussions of specific task areas. The objectives of each chapter are outlined below:

Chapter 1: To identify life cycle cost procurement policy, key definitions and the role of the contracting officer.

Chapter 2: To provide an overview of the system acquisition process with emphasis on acquisition policies and contracting implications.

Chapter 3: To provide guidance in selecting and developing a life cycle cost procurement strategy and related management considerations.

Chapter 4: To provide an understanding of the nature and unique features of life cycle cost procurement techniques and contract incentives and factors to be considered in selecting the best life cycle cost procurement technique for a particular program.

Chapter 5: To provide an understanding of reliability and maintainability programs and their relationship to life cycle cost procurement.

Chapter 6: To discuss key program documents and their relationship to life cycle cost procurement.

Chapter 7: To provide guidance on planning and executing source selection activities involving a life cycle cost procurement.

Chapter 8: To provide guidance with respect to life cycle cost procurement implications on contract implementation activities.

Chapter 9: To summarize key lessons learned on current and past programs.

Although the material contained in this document is primarily directed at acquiring major defense systems, most of the guidance is also applicable to equipment procurements.

1-4 Definitions

Design to Cost. "A management concept wherein rigorous cost goals are established during development and the control of systems costs (acquisition, operating and support) to these goals is achieved by practical tradeoffs between operational capability, performance, cost, and schedule. Cost, as a key design parameter, is addressed on a continuing basis and as an inherent part of the development and production process."
Source: DoDD 5000.28

Design to Cost Goal.* "A specific cost number, in constant dollars, based upon a specific production quantity and rate, established early during system development as a management objective and design parameter for subsequent phases of the acquisition cycle."
Source: DODD 5000.28

Average Unit Flyaway Cost. "The average unit flyaway cost (equates to Rollaway and Sailaway) related to the production of a usable end-time of military hardware. Flyaway cost is defined in DoD Manual 7110.1-M and includes the cost of procuring the basic unit (airframe, hull, chassis, etc.), a percentage of basic unit for changes allowance, propulsion equipment, electronics, armament, other installed Government-furnished equipment, and nonrecurring production costs,"
Source: DODD 5000.28

Production Unit Cost (PUC) Goal. The contract actual unit production cost goal. This goal frequently will differ from the overall flyaway cost goal since it will normally not include internal DoD investment costs nor engineering change allowances. It may also be desirable to exclude GFE and contractor nonrecurring costs from the contract PUC goal. Both DoD and the contractor must have specific understanding of the elements in the goal which must be defined in the production contract to preclude future misunderstandings.

Operating and Support Cost Goals. "The major operating and support cost factors shall have DTC goals established in the form of measurable numbers (e.g., numbers of O&S personnel, reliability and maintainability factors, etc.) which can be

* At this stage of the design to cost concept development, DODD 5000.28 requires that a program have only a single monetary design to cost goal. This goal is an average unit flyaway cost goal (a production cost element) established by the Secretary of Defense for major programs and by higher designated authority within each Service for less than major programs. It is to be established as soon as possible but not later than entry into engineering development. This goal is an in-house Government goal, almost contractual in nature, between the Service program manager and the Secretary of Defense or between the program manager and a higher designated authority. Additional guidance on the nature and establishment of DTC goals can be obtained from the 1976 update of the Joint Logistics Commanders Guide on Design to Cost, AFLCP/AFSCP 800-19.

monitored during test and evaluation as well as in operation. These factors shall have emphasis equal to other cost factors in acquisition cost management."
Source: DODD 5000.28

Life Cycle Cost (LCC). "The LCC of a system is the total cost to the Government of acquisition and ownership of that system over its full life. It includes the cost of development, acquisition, operation, support, and where applicable, disposal."
Source: DODD 5000.28

Life Cycle Costing. The consideration of life cycle cost or segments thereof, in various decisions associated with acquiring an item of equipment or a defense system."
Source: AFR 800-11

Life Cycle Cost Procurement. "A procurement in which LCC (or segments of it) is considered in awarding the contract. It includes the:

(1) Procurement of a defense system or subsystem when the cost of the life cycle (or segments of it) is quantified in monetary terms and is a factor in source selection (or in noncompetitive selection, when the quantified cost is established as a contract commitment.

(2) Competitive procurement of a reparable item when segments of the LCC are quantified in monetary terms and the contract is awarded on the basis of the lowest total cost.

(3) Competitive procurement of a nonreparable item when the contract is awarded on the basis of lowest cost per unit of service life.

(4) Noncompetitive procurement of an item when the contractor is allowed to propose a price, for example, for more than one level of reliability, where the logistics costs are quantified for the various acceptable levels and award is based on the lowest overall cost."
Source: AFR 800-11

Should Cost. Should cost is a concept of contract pricing that employs an integrated team of Government procurement, contract administration, audit, and engineering representatives to conduct a coordinated, in-depth cost analysis at the contractor's plant. The purpose is (1) to identify uneconomical or inefficient practices in the contractor's management and operations and to

quantify the findings in terms of their impact on cost, and (2) to develop a realistic price objective which reflects reasonably achievable economies and efficiencies. When developing the business strategy for major system procurements, a should cost study is to be considered and will be conducted on systems or items requiring DSARC approval. ASPR 3-801.2(b) contains additional detail.

1-5 Role of the Contracting Officer

The contracting officer provides support to the program manager in all the procurement aspects of the program. Support in life cycle cost procurement is of particular importance because its application will be new to many program managers. It is necessary that the contracting officer be involved in the earliest program planning to develop the procurement strategy and to assure that key milestones and documents, such as specifications, drawing packages, Decision Coordinating Papers, Advanced Procurement Plans, Requests for Proposals, contracts, etc., are realistic and consistent with statutes and regulations. The contracting officer's responsibilities include:

a. Participating in developing presentations to higher authority on the business aspects of the procurement including DSARC presentations, Program Management Reviews and Source Selection Procedures.

b. Preparing Requests for Proposals (RFPs).

c. Participating as a principal in Request for Proposal reviews and other formal reviews related to business matters, either formally designated by the program manager or higher authority.

d. Developing, in conjunction with program and legal staff, special contract provisions consistent with the acquisition approach of the program.

e. Ensuring the specifications, the Statement of Work, the special provisions, and the DD 1423s are consistent, and ensuring they conform to program direction. Also ensuring that the definitions of cost in the program management reporting system, the contractor cost data reporting system, and the contract line items are consistent.

f. Negotiating, preparing and executing contracts and modifications to contracts.

g. Briefing program office, support, and field personnel in order to assure they understand exactly what is contractually required.

h. Working closely with program and appropriate field offices

to monitor contractor's progress, control changes, and provide timely administration and prevent claims.

Subsequent chapters provide guidance for accomplishing these responsibilities. Emphasis is placed on applying life cycle cost procurement procedures.

Chapter 2

System Acquisition Overview

2-1 Objective

The objective of this chapter is to provide an overview of the system acquisition policies and contracting implications. It is not the intent to cover all aspects of the acquisition process. AFSCP 800-3 is an excellent source of additional guidance and information on the many acquisition events and activities.

2-2 Acquisition Management Summary

The Department of Defense manages the acquisition of major defense systems by means of Decision Coordinating Papers (DCPs) which are reviewed and acted upon by the Defense Systems Acquisition Review Council (DSARC). When the Air Force is ready to initiate a major defense system program, a DCP is prepared in accordance with DOD Directive 5000.2. Information included in the DCP addresses the need/threat, concept, milestones, thresholds, issues and risks, alternatives, management plan, supporting rationale and affordability in terms of projected budget and phasing of out-year funding. The DCP is submitted to the DSARC. The principal members of the DSARC are the Director of Defense Research and Engineering, Assistant Secretary of Defense (Installations and Logistics), Assistant Secretary of Defense (Comptroller), Assistant Secretary of Defense (Program Analysis and Evaluation and, for programs within their areas of responsibility, the Assistant Secretary of Defense (Intelligence) and Director of Telecommunications and Command and Control Systems. Operating in accordance with DOD Directive 5000.26, the DSARC reviews the DCP and associated evaluations and reports prepared by DOD staff. Among the reports are those prepared by the Deputy Director, Test and Evaluation and the Cost Analysis Improvement Group (CAIG). At the conclusion of the DSARC review, the DCP is revised, if necessary, and then signed by both the Secretary of the Military Department sponsoring the program and the Secretary of Defense. It then becomes an agreement between the two on the program parameters the Military Department Secretary is expected to operate within. If there is a breach or a forecast of breach in any of these parameters, it is the responsibility of the Secretary of the Military Department to inform the DSARC Chairman of this expected breach and request a DSARC meeting to consider alternative courses of action open to the Secretary of Defense. Approval to proceed to the next phase, e.g., validation, full scale development or production, is accomplished through this formal DOD management and decision-making system.

The DCP, from its inception at the time of program initiation, through production, includes a section on the specific procurement approach that is planned. Risk assessment is an important ingredient in selecting the appropriate acquisition strategy. Each program is unique and therefore the strategy should be clearly laid out in the initial DCP and modified only if the corresponding technology advancement (originally assumed) is not borne out during development, or if major changes in program approach are determined to be necessary. The Procuring Contracting Officer (PCO) is responsible for assisting the Program Manager (PM) in preparing the PM's input to the acquisition strategy section of the DCP.

The most effective means of motivating contractors is competition. Competition is also a key element in obtaining the widest practical spectrum of applicable technological approaches to the satisfaction of a military need. Thus competition is particularly desirable in the formative phases of an acquisition. Where potential savings are significant, it should be maintained through validation, full scale development and production. However, even when competition for the entire system is not maintained, it may be advantageous to introduce and maintain competition in the procurement of critical subsystems.

2-3 Conceptual Phase

During this phase the technical and economic bases for proposed systems are investigated and critical technical, operational and logistic support issues/problems are identified for resulution in subsequent phases. Contractual documents during this phase normally are cost type or fixed price level of effort and contain few firm technical, cost or schedule requirements. These contracts should call for innovation, should be limited by as few constraints as possible and result in one or more conceptual system descriptions which satisfy the stated mission. There is little or no hardware involved. As the system definition proceeds and alternatives are examined and eliminated, early configurations of hardware, usually critical subsystems, are created and tested. Hardware, however, is seldom the most significant product of such contracts. The end item of these contracts is the data which, in the form of studies, analyses, test results and conceptual drawings and specifications, demonstrates that concepts exist which have a high probability of satisfying the mission at an affordable cost in a reasonable time.

Based on the information derived during the conceptual phase, the Air Force documents the considerations which support the determination of the need for a system program, together with a plan for conducting the program. This plan is incorporated in the basic DCP and is updated during the later phases of the program. A preliminary design-to-cost objective for the acquisition and support costs will be included in this DCP as well as technical and schedule expectations to be attained during the validation phase. Thresholds will be established for the critical parameters of the program (schedule, cost and technical) and included in the DCP. The conceptual phase is concluded with approval of DSARC I and authorization from the Secretary of Defense to enter into the next phase, validation. This phase will be conducted within the parameters of the DCP approved at the end of the conceptual phase.

2-4 Validation Phase

During this phase hardware assumes a much greater importance as a means of verifying and defining preliminary design and engineering concepts, risk reduction, and analyzing tradeoffs. DOD policy requires that models, prototypes, mock-ups, and system hardware and testing thereof will be used to the greatest possible extent so that any decision to proceed further is based upon tested performance of system hardware and upon cost data reflective of actual fabrication results. Competition among two or more concepts and contractors in this phase should be accomplished whenever resources are sufficient. Competition will normally be conducted for technical innovations, but it can also be the basis for obtaining cost reductions when the item is within the "state-of-the-art" and relatively low in risk. Competition is particularly important in this phase whenever it will be uneconomical to continue competition into full scale development. In these cases, the concepts and contractors selected will be those that will continue into initial production and in many cases will also be the only ones feasible for full production and deployment. Thus the assessments to be made must address both the suitability of the concepts and the capabilities of the proposed contractors. Testing operational prototypes is desirable, whenever feasible. If it is not feasible to test complete prototypes, then alternatives such as testing prototypes of major subsystems and competitive development of hardware should be considered.

The major goals of the validation phase are to reduce technical, cost and schedule risk, to accomplish more detailed planning, to resolve or minimize logistic problems, and to prepare formal requirement documents that translate the requirements into a solicitation package for full scale development. Thus the contracts for this phase should assure the acquisition of

sufficient data rights to allow the Government the use of all development efforts in the succeeding full scale development. Consideration of risk and the fact that the majority of the validation phase contracts will require "best efforts" only from the contractors will generally drive the selection of contracts to cost reimbursement types.

When the Air Force is sufficiently confident that program worth and readiness warrant commitment of resources to full scale development, it will update the program DCP and request a Secretary of Defense decision to proceed. At that time, the DSARC II will normally review program progress and suitability to enter this phase and forward its recommendations to the Secretary of Defense for final decision. Upon approval, the program enters into the third and final development phase, full scale development.

2-5 Full Scale Development Phase

During this phase the system, including all items necessary for its support, is fully developed, engineered, fabricated and tested. The contract(s) for this phase should take the design and/ or product of the validation phase and further develop it for operational use with as low a cost in production as possible without unduly sacrificing quality and with full consideration of life cycle cost (LCC). To provide the flexibility to accomplish these tasks, cost-type contracts with some incentive to reduce cost on the instant contract but with the primary incentive on reducing total LCC are preferred. It is not DOD policy to place production options in development contracts that would obligate the contractor for unreasonably long periods of time and could be interpreted as a return to the Total Package Procurement (TPP) concept. However, DOD's policy of spending considerable time and resources in the validation phase lowers the risk to both the full scale development (FSD) contractor and to the Government. As a result, in those cases where the validation phase has lowered the risks to an acceptable level, it is reasonable to consider the inclusion of not-to-exceed option prices (with economic price adjustment provisions) for pilot production or Low Rate Initial Production (LRIP) quantities. Alternative approaches include using a provision in the full scale development contract for basing a portion of the production contract profit or fee on the degree of success in achieving the DTC goal, and including an incentive in the development contract based on the degree of success in meeting the DTC goal and/or Life Cycle Cost Target. The latter approach can be used in combination with the other approaches. The first approach rewards the low cost producer and is particularly effective when the contractor would prefer the opportunity for higher future profits versus the immediate incentive opportunity.

The incentive under this approach is similar to the value engineering future acquisition sharing concept (see ASPR 1-1703.1 and ASPR 104.44e).

In all cases, full scale development contracts shall contain design-to-cost (DTC) provisions. Whether the full scale development contract contains DTC requirements alone or in combination with options for limited production quantities, the PCO is responsible for assuring that the impact of any engineering change proposals (ECPs) approved during full scale development is incorporated in the option and/or DTC provisions. Since this requirement for incorporation of ECPs is mandatory in administration of the full scale development contract, it is suggested that the specifications allow the contractor flexibility for tradeoff purposes.

When the Air Force is sufficiently confident that engineering is completed and the commitment of substantial resources to production and deployment is warranted, it will request a Secretary of Defense decision to proceed. At that time, the DCP will be updated and the DSARC III will again review program progress and suitability to enter substantial production/deployment and forward its recommendations to the Secretary of Defense for final decision.

2-6 Production and Deployment Phases

During these phases of system acquisition, use of fixed price contracts often is appropriate. Whenever feasible, the initial production should be of a pilot quantity to verify the design and to provide a sound basis for pricing subsequent production. In view of the scale of production contracts for major weapon systems, the Procuring Contracting Officer must give particular attention to realism of delivery requirements, warranty provisions, and all special provisions including support cost commitments, price adjustments, operating and support cost incentives, and life cycle cost verification tests.

2-7 Program Reviews

All acquisition programs are subject to high level management reviews at various points in the system acquisition process. Major programs must, of course, prepare for the DSARC reviews. Both major and smaller programs are reviewed at HQ USAF and HQ AFSC on a regular basis. Design-to-cost and life cycle costing inputs are required at these reviews. Other issues of concern include source selection criteria, the effects of incentives, the results

of testing, and the evaluation of design-to-cost goal attainment. Three different types of formal reviews below the DSARC level which are concerned with design-to-cost and life cycle costing issues are (1) the Program Assessment Review (PAR), (2) the Command Assessment Review (CAR), and (3) the Secretary of the Air Force Program Review (SPR). The PAR briefing is presented to HQ AFSC, the Air Force Council, the Air Staff Board and to the Secretary and Chief of Staff of the Air Force. In these final two reviews, the PAR is known as the SPR. The CAR process reviews those AFSC programs not reviewed by the PAR/SPR process and is conducted at HQ AFSC. Specific issues and required presentation formats are contained in AFSCP 800-23.

The Program Manager is responsible for presenting a formal briefing to the Division Commander, Vice Commander, and their staffs. This review is called a Program Management Review (PMR) and follows the same format as the CAR. These reviews should emphasize design-to-cost and life cycle costing activities and issues especially in the areas of design-to-cost and life cycle cost tracking and goals.

Designated AFSC acquisition programs may be considered for a Joint Operational and Technical Review (JOTR) on a scheduled basis. The objectives of the JOTR are to provide the AFSC Commander and the commanders responsible for operating (or using) and supporting the system with a synopsis of the relationships between operational and support concepts, stated system requirements, characteristics of the conceptual design or designs, technical difficulties, and potential life cycle costs. Procedures for these reviews are contained in AFSCR 800-18.

Chapter 3

Life Cycle Cost Acquisition Strategies

3-1 Introduction

A life cycle cost acquisition strategy is an overall plan for addressing successive acquisition program decisions and activities to assure achievement of a stated set of objectives or timely termination of the program. Development of the strategy is the responsibility of the Program Manager with guidance provided by the Procuring Contracting Officer. The resulting program life cycle cost objectives and the plans and actions necessary to implement these objectives should be documented.

The Program Manager, upon receipt of program direction reviews the program and establishes a clear statement of goals. Goals are set within constraints imposed at all levels of management, i.e., using command, HQ USAF, HQ AFSC, etc., as reflected in the program direction. These constraints usually address as a minimum the following areas:

- Performance requirements
- Schedule requirements
- Budget limitations
- Design-to-cost goals
- Life cycle costing requirements

Upon completion of this action, the Program Manager reviews life cycle cost acquisition strategies for possible application to the new program. An interim strategy or approach may then be established.

If the Program Manager desires assistance in final strategy determination, he can establish an LCC planning team. The LCC planning team is normally composed of representatives from the program office, Comptroller, Engineering, Procurement and the AFLC Acquisition Logistics Division. Tasks are assigned to team members to determine availability of data required to support the interim strategy established. The Program Manager schedules milestones for data inputs and follow-up team meetings. Based on data provided by the team, the interim strategy is pursued or modified. The overall acquisition strategy should be documented in Section 3 of the Program Management Plan. A Life Cycle Cost Plan may also be prepared. The purpose of this plan is to document the integrated plan for the time phased activities required to accomplish a specific set of life cycle cost objectives. All activity descriptions should include what is to be done, who is to do it, required resources and important milestones. The plan should also include a description of procedures to be used in managing and integrating the activities so as to assure timely and effective achievement of the specified objectives.

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Typical responsibilities under this team approach may be as follows:

Program Manager

- Receives direction - PMD, AFSC Form 56
- Reviews/identifies program constraints and establishes program goals and selects interim LCC approach
- Calls for and chairs an LCC Planning Team meeting to review various LCC approaches
- Provides the team a review of the program
- Assigns tasks to team members to develop technical inputs for the LCC approach

Team Actions

- Determine availability of logistics cost data required for various LCC approaches
- Develop an LCC model which includes development, acquisition, operating and support costs, as appropriate
- Prepare necessary technical documentation such as the work statement, reliability and maintainability requirements and goals and both bench and field test requirements.

Follow-Up Team Meetings

- Team member technical inputs are reviewed and a final LCC approach is determined

Procurement Office

- Prepare implementing Procurement Plans and RFP

3-2 Typical Acquisition Strategies

Some typical LCC acquisition strategies[1] are described below:

Strategy 1 - Two or more contractors compete during development and preproduction qualifications, at the end of which one contractor is selected for the remainder of the program.

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1. Source: LCC-3, DOD Life Cycle Costing Guide for Systems Acquisition, January 1973 (Interim).

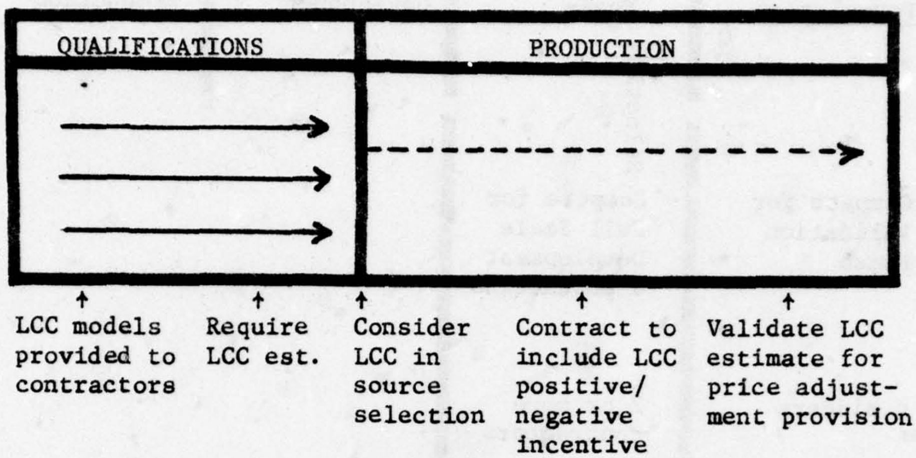

Figure 3-1

This strategy was used for an equipment modernization program. The current equipment used in most Air Force aircraft has an extremely low mean time between failure and a high maintenance cost. A program was initiated to replace this equipment with a more reliable, cost effective product. Life cycle cost was used as the primary basis for award of the production contract. The contract provides for an extensive testing program under actual field conditions in order to verify the life cycle cost target costs set forth in the contract. Upon completion of verification testing, the contract price may be adjusted depending upon test results. The contract was awarded on a Firm Fixed Price (FFP) basis with a positive/ negative incentive provision.

Strategy 2 - Two or more contractors compete through the validation phase, at the end of which one contractor is selected for the remainder of the program.

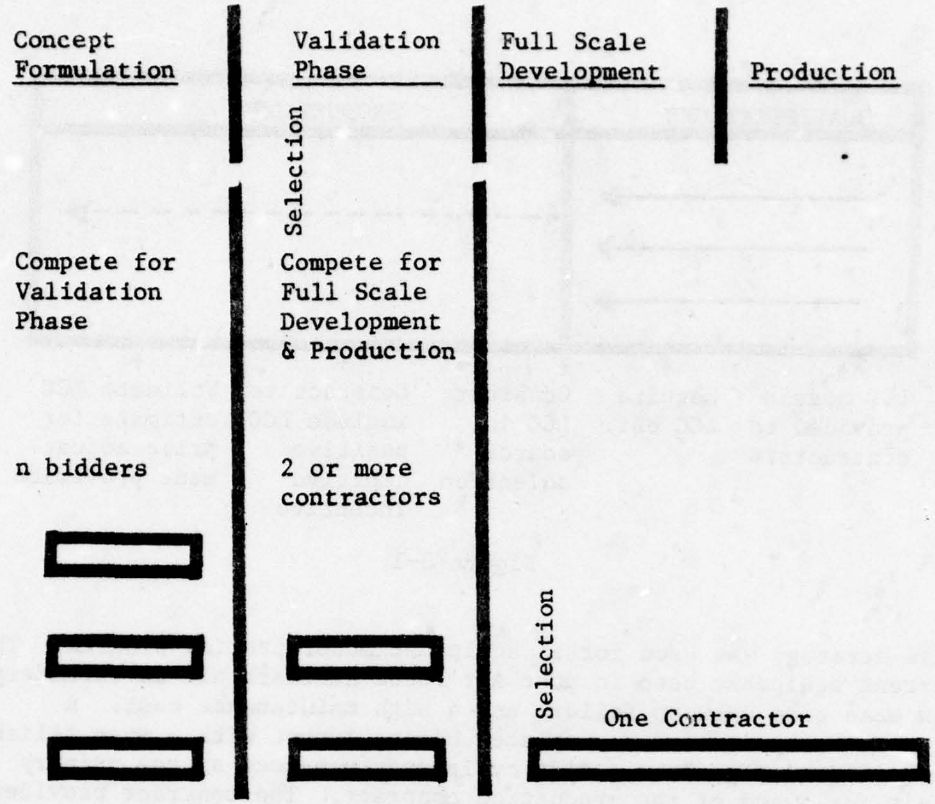

Figure 3-2

The above strategy was used in the development of an electronic countermeasure. Emphasis was on improving the consideration of LCC in the initial design process. The competitive validation with two contractors included requirements for the contractors to make tradeoff studies. The two contractors were provided a support cost model. The contractors were required to consider design alternatives and make LCC analyses for these alternatives. The SPO analyzed the reports and evaluated the data in various ways, i.e., levels of maintenance for the Line Replaceable Units (LRUs), evaluation of Mean Time Between Failures (MTBFs) on expensive LRUs, compared MTBFs with reliability data in MIL-HDBK-217. The RFP for the full scale development effort included the cost model and provisions for obtaining LCC estimates. The award evaluation criteria, which covered six areas, included a cost validity area. The RFP stated that the evaluation would cover development cost, production cost, and logistics support costs. The full scale development contract requires the contractor to conduct LCC analyses to minimize cost of ownership consistent with the overall design to

production unit cost requirement. The contractor is required to use the AFLC logistics support cost model. The contract also includes a data item requiring a semiannual report on LCC. ECP/CCP submittals are required to contain a life cycle cost impact assessment. The contractor is also being requested to submit, at the end of the full scale development, a cost proposal for a Reliability Improvement Warranty. The LCC data provided by the contractor will be evaluated against that provided in the proposal for Phase II and against MTBF goals for each LRU. The contracts awarded thus far did not include monetary motivation to reduce ownership cost. There is no particular need for an additional monetary incentive to motivate the contractor when competition exists in the validation phase. However, the contractor is specifically required to make LCC design trade studies and these efforts are monitored to insure that such requirements are complied with. Monetary positive or negative incentive provisions are considered appropriate when the contractor's LCC estimates play a major role in selection for full scale development and competition has ended. In this case consideration is being given to a Reliability Improvement Warranty. The full scale development contract contains incentive provisions on the design to unit production cost goal. An essential part of management control is to assure that unit production cost is not emphasized to the detriment of ownership costs.

Strategy 3 - Two or more contractors compete through the validation phase at the end of which one contractor is selected for the remainder of the program. This strategy differs from Strategy 2 in that parallel prototypes are developed during the validation phase.

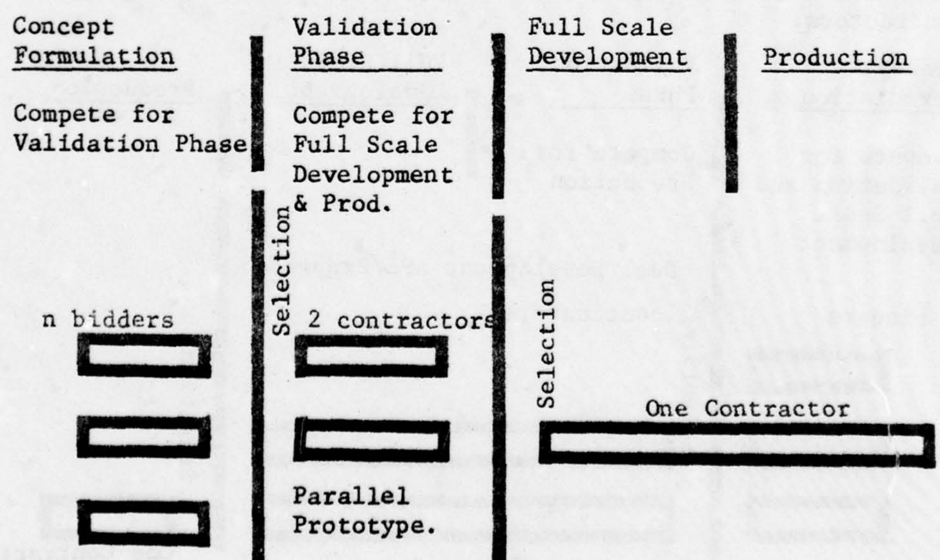

Figure 3-3

This strategy was used in a recent airframe procurement. The aircraft is being built to a unit flyaway cost goal with life cycle cost award-fee provisions. Life cycle costing was introduced by notification to all potential prototype program contractors that one of the criteria for choosing the full scale development contractor would be an estimate of the ten year operating and support costs associated with each proposed design. They were also informed that this operating and support cost estimate would be computed with a standard Air Force supplied mathematical model, a tentative version of which was forwarded to each offeror. Two prototype program contractors were selected from initial bidders. At the end of the prototype development, proposals were requested for the full scale development effort. Both contractors submitted separately bound logistics analyses including data and supporting information for the Government supplied operating and support cost model. This information was considered in selecting the full scale development contractor. The contract covering the airframe and engine includes a life cycle cost award fee provision. The basis for determining the level of award fee includes a comparison of the operating and support cost estimate measured during the field verification test to the target operating and support cost estimate contained in the contract.

Strategy 4 - This strategy, used on a recent radar acquisition, provided for competition during the concept formulation phase with two contractors competing through full scale development. Following this, one of the competing contractors will be selected for the production phase. This strategy involves Advanced Production Engineering (APE) and preproduction of a system by the two competing contractors.

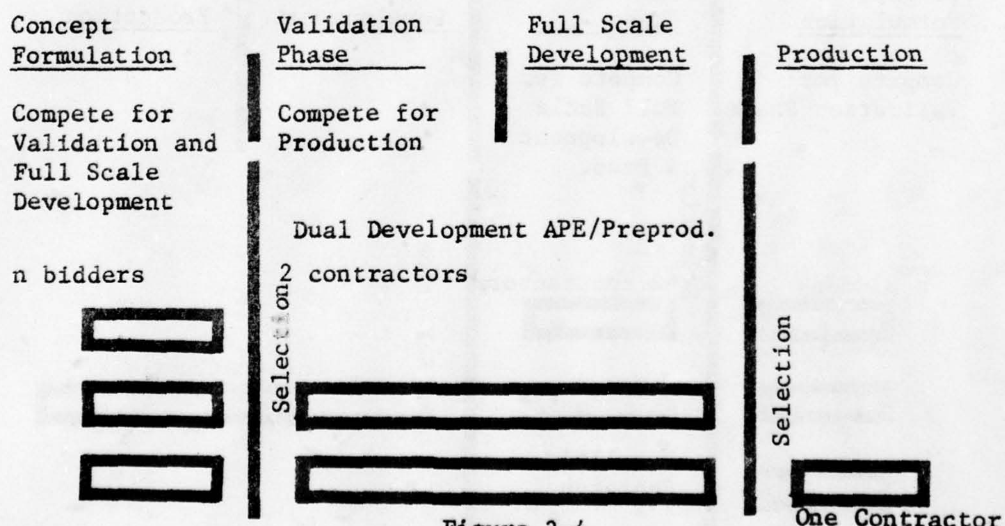

Figure 3-4

The purpose of the program is to develop, qualify and integrate the system into the Air Force's tactical aircraft inventory. The first objective is to place the units on an operational type aircraft. LCC analyses are being prepared by the contractors, and will be used as a part of the decision criteria for the award of the production contract.

Two contracts were awarded to develop the R&D prototypes during the validation phase. After the validation phase, contracts were awarded to the same two contractors for the full scale development of preproduction articles (four per contractor). These contracts included a cost model (covering spares, data management, supply management, AGE, operating personnel and maintenance cost). The contractors will be required to submit their estimates of LCC which will be validated during test on the preproduction articles. The validated cost will be a matter of consideration in selecting the production source at the end of the full scale development phase.

In addition to the strategies depicted above which are currently incorporated into contracts, the following are included for review and possible future use.

Strategy 5 - This strategy depicts an LCC approach where there is only one source of supply. This can be achieved by requiring proposals for different levels of reliability in combination with a given logistics support cost model. The direction to proceed would be based on the lowest overall combination of acquisition and O&S costs.

The LCC model would provide data in order for the Government to make tradeoff decisions between acquisition and O&S cost. Development and procurement would then proceed with the lowest overall cost to the Government option.

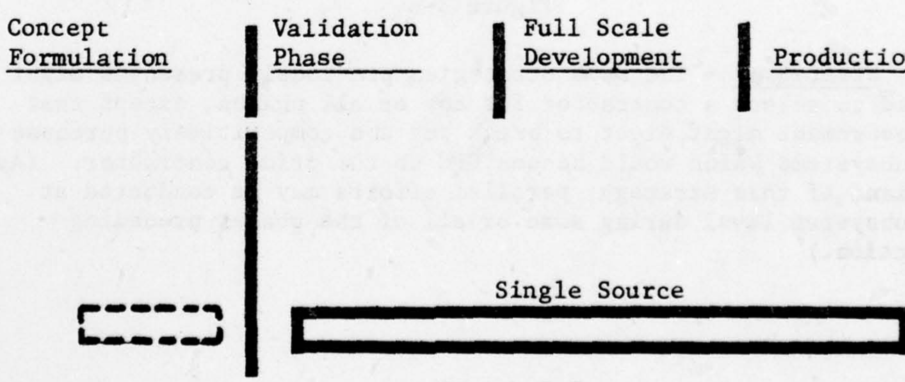

Figure 3-5

Strategy 6 - In this instance, a single contractor is selected for Advanced Production Engineering (APE) and limited production, by using any of the previous strategies. During full scale development, the Government would obtain reprocurement data. Using this data, competition would again be employed for selection of a contractor for production of the required quantity. An LCC model would be provided to the bidders in the RFP. An analysis of the proposals using the LCC model to determine the lowest overall cost to the Government would be one of the major factors for award.

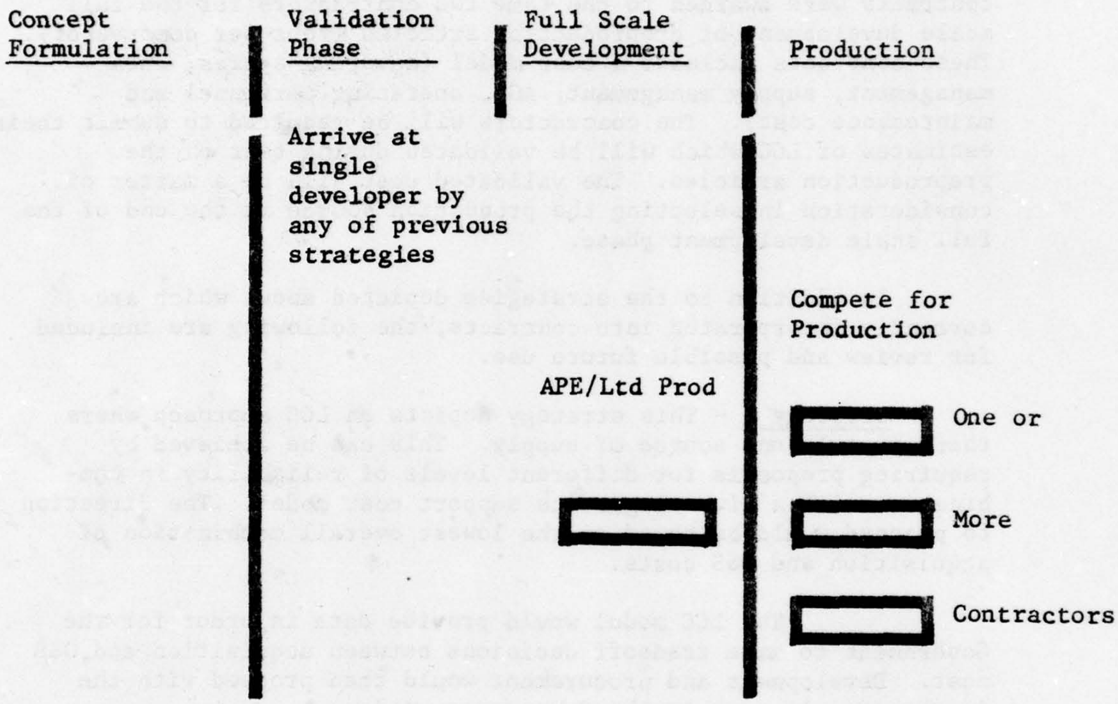

Figure 3-6

Strategy 7 - The same strategies previously presented might be used to select a contractor for any or all phases, except that the Government might elect to break out and competitively purchase "n" subsystems which would become GFE to the prime contractor. (As a variant of this strategy, parallel efforts may be conducted at the subsystem level during some or all of the phases preceding production.)

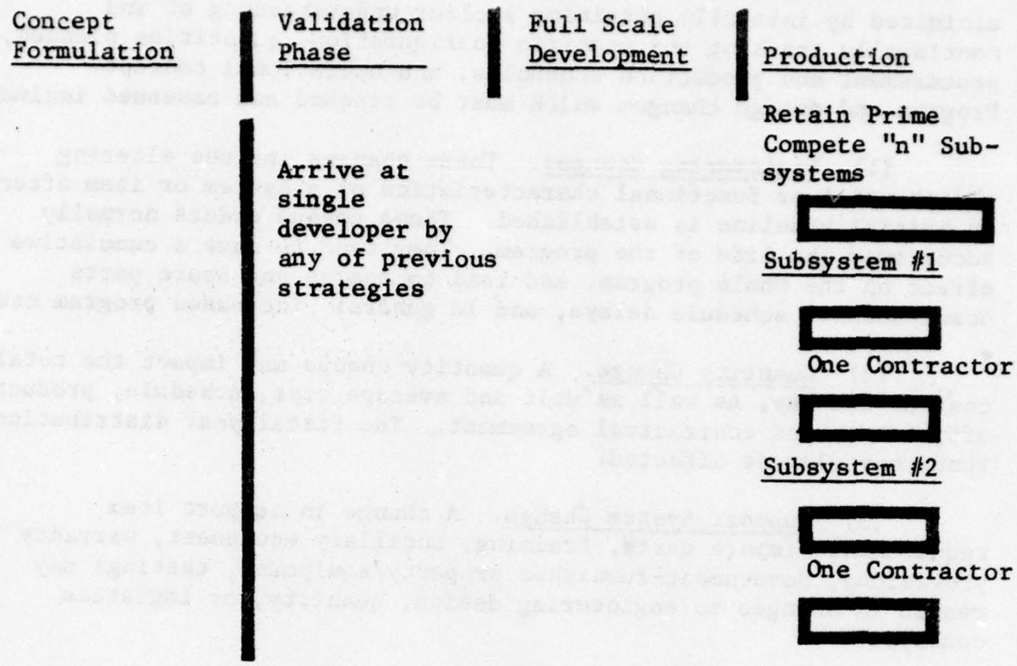

Figure 3-7

3-3 Related Management Considerations

3-3.1 Uncertainty

Although risk and uncertainty are frequently used as equivalent terms, a useful distinction may be made between them. A risk situation is one in which the outcome is an uncontrollable random event stemming from a known probability distribution. For example, the toss of a coin involves a risk with a 0.5 probability of a head turning up. An uncertain situation is characterized by the fact that the probability distribution of the uncontrollable random event is unknown.

Making useful cost predictions of future weapon systems varies in complexity and difficulty, depending upon the degree of definition and specification of the system and the availability of pertinent historical cost data in suitable form for processing. Whenever possible cost estimates should identify the degree of uncertainty and anticipated risks which could significantly affect costs. The sources of uncertainty and risks are many and are often difficult to identify and describe. Generally, the sources of uncertainty can be related to either system definition and cost estimating methods.

Uncertainties with respect to the system definition may be minimized by initially obtaining a clear understanding of and continually tracking the specific configuration, quantities planned, procurement and production schedules, and operational concept. Program and design changes which must be tracked and assessed include:

(1) Engineering Changes. These changes include altering the physical or functional characteristics of a system or item after an initial baseline is established. These change orders normally occur over the life of the program. They tend to have a cumulative effect on the whole program, and lead to spares and spare parts obsolescence, schedule delays, and in general, increased program costs.

(2) Quantity Change. A quantity change may impact the total cost of the buy, as well as unit and average cost, schedule, production efficiency, and contractual agreement. The fiscal year distribution of funds may also be affected.

(3) Support System Change. A change in support item requirements (spare parts, training, ancillary equipment, warranty provisions, Government-furnished property/equipment, testing) may result in changes to engineering design, quantity, or logistics concepts.

(4) Schedule Change. A change in delivery schedule, completion date, or intermediate milestone of development or production will usually impact the total program cost and the fiscal year distribution of funds. When a schedule changes, the impact of such items as overtime, production efficiency, and inflation must be considered.

(5) Policy Changes. Policy changes may impact significantly on the cost estimates. Thus, the concpets in effect when the estimates are made should be clearly identified. For example, procurement policy variables such as make or buy, GFE vs CFE, etc., are many, and often affect costs.

Uncertainties with respect to cost estimating concerns data and their treatment in preparing cost estimates. The major causes of estimate uncertainty are inability to measure cost precisely, inadequacy of applicable data, statistical uncertainty, errors or inconsistencies in the treatment of these data, and errors of judgement. The treatment of cost estimating uncertainties should satisfy the following objectives:

(1) To reduce the uncertainties surrounding the estimate.

(2) To assess both the reasons for and the dollar impact of remaining uncertainty.

(3) To convey the degree of uncertainty to the estimate's user.

(4) To guide the user in interpreting the estimator's conclusions.

3-3.2 Risk

Figure 3-8 shows the theoretical situation of estimating system costs, wherein all economic, technical, and program factors have been completely and accurately forecasted. During the conceptual phase a single estimate of system cost may be constructed as shown by the vertical line. Each program acquisition cost estimate has expected errors resulting from both technical and program uncertainties and from those statistical processes used in prediction. Adding together the expected errors for the remaining acquisition phases (all of them in this case) produces the typical probability curve (curve A). The original single point estimate still has the greatest probability of occurring; it is the expected value of the system cost. However, significant variations in system cost also have high probability of occurring. There are then some small probabilities that the true system cost will deviate by large amounts from the central point estimate. As program acquisition proceeds, fewer phases remain to be estimated and the corresponding range of possible error is reduced. There is less anticipated error in the validation estimate and even less in the full scale development estimate. Since the assumption was made that the point estimate was accurate, the curves are different because the areas underneath the curves have the same 1.0 value required of all probability distributions.

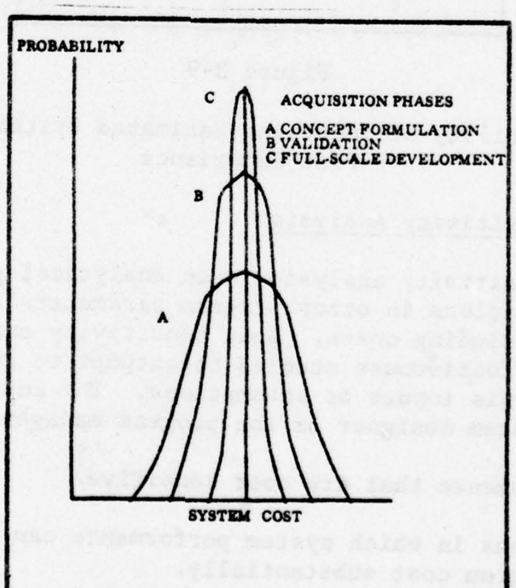

Figure 3-8

Probability of Incurring Estimated System Cost, Theoretical

Figure 3-9 gives the system cost estimate situation that experience shows can be expected. The error widths about the estimates are still the same, because the number of phases still to be estimated remain the same. However, subsequent cost estimates increase. This gap in our knowledge is due to the fact that while the error range due to predicted cost variances decreases as the program proceeds, the point cost estimate may increase to reflect new knowledge, unanticipated changes, escalation, early unwarranted options or other factors.

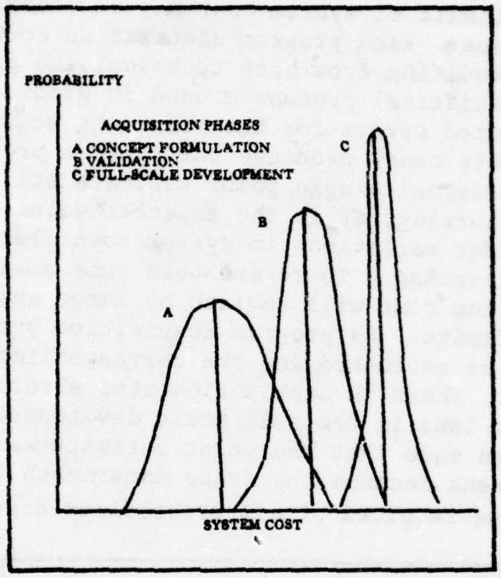

Figure 3-9

Probability of Incurring Estimated System Cost, Past Experience

3-3.3 Cost Sensitivity Analysis

Cost sensitivity analysis is an analytical procedure for determining how variations in other program parameters affect resource requirements including costs. Cost sensitivity analysis is frequently used in cost-effectiveness studies to attempt to reflect and assess uncertain analysis inputs or assumptions. The analyses are performed to help the system designer or the program manager identify:

(1) Elements that are cost sensitive.

(2) Areas in which system performance can be upgraded without increasing program cost substantially.

(3) Areas in which design research is needed to surmount substantial cost obstacles to achieving higher program performance.

(4) The total cost impact of uncertainties associated with a program.

Cost sensitivity analysis may be conducted at varying levels of detail during any phase of system acquisition.

3-3.4 Using Life Cycle Cost Estimates

Life cycle cost estimates should be a factor in most decisions in all phases of all strategies. While life cycle costs must be a consideration across the entire spectrum of decisions related to systems acquisitions, whatever strategy is used, the exact use of life cycle cost estimates will vary and the methods used for developing the estimates will also vary. Greater precision and a greater level of detail will progressively be needed as decisions proceed from the earliest and broadest ones to highly detailed decisions. Some of the earlier broad decisions may involve consideration of improving a current system versus initiating advanced development of a new system. Later decisions may involve such questions as whether to use an existing fire control system, to develop a new unsophisticated fire control system, or to push the state of the art with a new and sophisticated fire control system. More detailed decisions may involve such questions as whether to achieve appropriate levels of reliability by use of redundant "black boxes" or by using redundant circuitry within a black box. A certain amount of precision is required when life cycle cost estimates are used as contractual commitments, therefore, the strategy selected must permit the development of such an estimate. In all the strategies discussed in this chapter, life cycle cost estimates can be expressed as contractual commitments. However, life cycle cost goals should be established no later than full scale development and contractors should be informed during earlier phases of the acquisition, by provisions in requests for proposals and contracts, that such commitments may be required. The weight to be given life cycle cost estimates in source selection decisions associated with the strategies discussed in this chapter will depend upon the realism of the estimates and the level of confidence in them. Much will depend on the ability to identify cost driving parameters, the ability to measure these parameters and the ability of the Government to verify the parameter values. The value of the parameters are as important as the equations themselves. It is therefore important that the detailed values be visible and that they be evaluated for reasonableness by the various experts who support the program. It is important that the Government understand the test implication for obtaining the values and fulfill its obligations in completing the test programs.

3-3.5 Cost Data Reporting

Cost estimating is a critical component in the management of individual system acquisition programs. All cost analysis organizations (OSD Cost Analysis Improvement Group (CAIG), independent cost analysis teams, cost analysis organizations and program offices) rely on certain basic sources of data from which estimates and projections are made. Consistency in the way this data is reported is essential. The PCO is responsible to assure that this data is provided for under the contract. The primary source of data in support of the cost analysis is the Contractor Cost Data Reporting (CCDR) system (AFSCP 800-15). The primary objectives of this system are: (1) to establish a data base for use in developing cost estimates for long range planning, concept development, contract proposal evaluations during source selection, Decision Coordinating Papers (DCPs) and comparison of alternatives and tradeoff studies, and (2) to provide actual costs and "estimates to complete" for cost estimate updates.

Data comparability is a prerequisite for a valid data base from which to predict the cost of new systems. The CCDR must rely on the Contract Work Breakdown Structure (CWBS) for its reporting. It is important that as the CWBS is developed, a dialogue be established between the program office and the users of the cost data to ensure that the CWBS will provide the comparable cost breakouts necessary to support their functions. The earlier this dialogue is established the easier it is to resolve any differences or misunderstanding of requirements.

3-3.6 Treatment of Inflation

Procedures for adjusting cost to reflect inflation must be clarified in the initial groundwork in preparing life cycle cost estimates. Design to cost targets, as well as life cycle cost estimates, are generally directed to be made in constant dollars based upon a specific production quantity and rate. In order to compare actual costs against design to cost targets, it is necessary that cost indices be developed and maintained. Such indices must include all relevant cost elements such as the cost of labor, materials, services, etc. These indices can usually be based on information developed by the Department of Labor and Commerce or by industry associations. To be applicable to a particular program, however, the data may required modification. Economic escalation indices for use in Selected Acquisition Reports and DOD price deflators or price-level adjustment indices for use when more specific data are not available are contained in AFR 173-10. Additional guidance and information on the development and applications of appropriate indices should be obtained from the Comptroller or Procurement and Production functional specialists.

Chapter 4

Life Cycle Cost Procurement Techniques

4-1 Introduction

4-1.1 Objectives of Chapter

The primary purpose of this chapter is to describe the nature of a spectrum of currently identified types of life cycle cost procurement techniques and to assist in determining which technique, if any, is appropriate for the program in question. These techniques have the common characteristic that all are designed to motivate contractors to design, manufacture and deliver equipment with lower life cycle costs. Savings may be in the acquisition cost component of life cycle costs. However, primary emphasis is generally on reducing and controlling operating and support costs by transferring more responsibility to the contractor for equipment operating and support cost performance.

Since some of the life cycle cost procurement techniques discussed in this chapter have not been carried out to completion on Air Force procurements, some of the information provided here must be considered tentative. When the search for a best life cycle cost (LCC) procurement technique for a specific program has been narrowed, it is recommended that further guidance be sought from personnel associated with programs which have applied the provisions considered to be most appropriate.

4-1.2 Spectrum of LCC Procurement Techniques

It has been found that life cycle cost procurement provisions must be individually tailored to each program to properly transfer the appropriate amount of responsibility for O&S costs to the contractor. This has resulted in the development of a spectrum of LCC procurement techniques being used on current programs. This trend is likely to continue with the development of even more new LCC procurement techniques in the future. Table 4-1 lists currently identified LCC procurement techniques including a variety of LCC incentive provisions. Each item listed is discussed in this chapter. To help the reader understand and more easily compare various types of LCC procurement techniques, the discussions of each, except the use of life cycle cost as a source selection criteria, contains separate subsections on the following: (1) definition, (2) description, (3) advantages, (4) disadvantages, (5) selection criteria, (6) guidelines for application, (7) special procurement documentation, and (8) experience.

TABLE 4-1

LCC PROCUREMENT TECHNIQUES

Source Selection Criteria

Preaward Testing

DTC/LCC Design Trade Study Requirements

Reliability and Maintainability Acceptance Criteria

LCC Incentive Provisions

- Award Fee
- Support Cost Guarantee (SCG)
- Reliability Improvement Warranty (RIW)
- RIW with MTBF Guarantee
- Reliability Demonstration Incentive
- Fixed Price Repair with Incentive
- Design to Cost Incentive
- Value Engineering Incentive

All of the LCC incentive provisions included in Table 4-1 involve contractual language which will affect a contractor's profits depending upon how well he succeeds in designing and delivering a product with low life cycle cost characteristics. The first two items in Table 4-1 deal with actions which can be taken to select contractors whose products should have lower life cycle costs, but do not involve incentives tied to O&S cost performance. Use of life cycle cost as a source selection criteria is often part of, rather than an alternative to, the other techniques listed. The third and fourth LCC procurement techniques deal with specific O&S cost objectives which must be met, but for which there is no incentive to improve the contract or product performance beyond that specified.

4-1.3 Factors Bearing on Selection of Appropriate LCC Procurement Techniques

There are many factors bearing on which LCC procurement technique or combinations of techniques would be most appropriate for any particular program. They include many program and design factors which can affect the future operating and support costs and how well

these costs can be predicted at contract award. The nature of the competitive environment is important. Assuming even partial responsibility for operating and support costs involve uncertainty and risks many contractors would like to avoid if given a choice.

Factors which can cause uncertainty about what future operating and support (O&S) costs will be, include: (1) high performance requirements relative to current equipment, (2) a tight development schedule, (3) limitations on funds for development and testing, (4) mission changes, (5) design to cost acquisition goals, (6) employment or operations and maintenance concept, (7) support personnel efficiency, (8) training efficiency, (9) design uncertainty, which increases as performance specifications requiring state of the art advances, (10) quality control efficiency, (11) detail design decisions, (12) support equipment design and use, and (13) training material quality. It should be noted that a contractor has less control over the items near the top of this list. Therefore, when uncertainty is great in areas outside the contractor's control, techniques which place less responsibility and risk on the contractor, such as award fee and value engineering incentive provisions may be more appropriate. On the other hand if there is considerable experience with similar equipment and uncertainty results primarily from things such as design and quality control, over which the contractor has significant control, more demanding incentive provisions, such as a Support Cost Guarantee (SCG), Reliability Improvement Warranty (RIW) or RIW with an MTBF Guarantee are applicable.

4-2 Source Selection Criteria

Life cycle costing objectives may be achieved by making life cycle costs an important source selection criterion in procurements which may or may not use life cycle cost procurement incentive provisions. These two approaches are complementary in that use of life cycle cost as a source selection criterion motivates a contractor to consider life cycle costs prior to source selection, and use of incentive provisions provides a degree of contractor commitment to control or reduce life cycle costs after contract award. The joint use of these two techniques also motivates contractors to submit realistic O&S cost estimates at source selection because both positive and negative incentives will be tied to them. Additional guidance on using life cycle cost as a source selection criterion is contained in Chapter 7.

Use of life cycle costing as a source selection criterion is of limited value in motivating contractors to propose low life cycle cost designs unless they think the Air Force can distinguish between high and low life cycle cost designs. Preaward testing described in the next section leads to the most effective use of life cycle cost as a source selection criterion. Aircraft tire vendors have been motivated to greatly improve the life cycle cost characteristics of

their products since the Air Force began to buy tires using life cycle cost as the primary basis for selection. By using preaward testing, the Air Force knows at the time of source selection which vendor has the best, lowest life cycle cost, tire. Even more important with respect to motivating the contractor, is the fact that the contractor knows that the Air Force knows the relative life cycle cost characteristics of competing designs. It cannot be overstressed that the Air Force must make every effort at the time of source selection to make a valid determination of which bidder is offering a program and design which will result in the lowest life cycle costs.

4-3 Preaward Testing

4-3.1 Definition

A procurement approach to reducing life cycle costs, primarily characterized by testing to assess important life cycle cost related characteristics prior to source selection.

4-3.2 Description

This LCC procurement technique differs somewhat from most others in several important ways. The most important of these is that the contract is awarded based on demonstrated LCC related performance. Precontract award tests are conducted to assess the LCC related equipment characteristics of each offerors' equipments, and the results of these assessments expressed in terms of life cycle costs, are used as the primary basis for source selection. In some cases, such as the procurement of aircraft tires, the contract itself does not contain any LCC incentives, other than provisions to assure that the quality of the equipment demonstrated to prior to contract award is maintained throughout production. This technique requires early configuration baselining and extensive configuration tracking of changes.

In other applications, such as the ARC-XXX/ARC-164 program, preaward testing is used in conjunction with other types of LCC incentive provisions, generally augmenting them by providing a more credible basis for source selection and establishing more equitable life cycle cost incentive targets. Preaward testing is a valuable technique when the equipment is purchased from a Qualified Products List (QPL) or when a number of competitors can produce a few units of required performance without large investments or other commitments.

4-3.3 Advantages

An important advantage of preaward testing is that the source selection is based on facts concerning performance of equipment, not on promises. Another very important advantage of this type of provision is that it does not require development and operation of a post-award measurement system to accurately verify the operating and

support cost performance of the equipment in the field. Because of the uncertainties involved, it is sometimes difficult for the Government and contractor to agree on realistic testing which will equitably assess the O&S cost performance of the equipment some three to five years in the future. Another advantage is that this approach motivates contractors to innovate lower life cycle cost designs while they are still in competition with each other to get the prime development and production contract. Since contractors are most highly motivated by an opportunity to get a new contract, this approach takes maximum advantage of opportunities to motivate contractors to reduce operating and support costs.

4-3.4 Disadvantages

One disadvantage of this type of incentive provision is that it does not motivate the contractor to further reduce the life cycle costs of his equipment after contract award. The greatest disadvantage of this technique is its limitation to equipment procurements where it is feasible to buy and test equipments from competing vendors prior to making a source selection decision. Another disadvantage may be the delay in procuring developed or "off-the-shelf" hardware.

4-3.5 Selection Criteria

By far the most important of the selection criteria is the affordability of testing and whether or not competing contractors can provide representative samples of their production design for adequate testing prior to the time at which source selection must be made. Where new performance capabilities are sought, this criterion is not likely to be met. There will be circumstances where there is neither time nor money to accomplish the testing required.

4-3.6 Guidelines for Application

There are two major steps in applying this type of life cycle cost provision. The first is appropriate selection of candidate equipments, considering the selection criteria mentioned above as well as the advantages and disadvantages of this approach. The second major step is the development of testing and source selection procedures and criteria by which the Government can, with the full knowledge of competing offerors assess the relative life cycle costs of each offeror's equipment. Additional guidance on applying this type of provision is contained in the DoD Life Cycle Costing Procurement Guide (Interim) LCC-1, dated July 1970.

4-3.7 Special Procurement Documentation

This type of provision requires extensive documentation of the preproduction, presource selection testing to ensure tests are being performed on an equal basis and to ensure the validity of the test data. It also requires that retest provisions be included to assure

that the contractor maintains the level of equipment quality throughout production, equivalent to that submitted for the original preaward testing. Guidelines and sample provisions are provided in LCC-1, DoD Life Cycle Cost Procurement Guide (Interim) and LCC-2, DoD Casebook Life Cycle Costing in Equipment Procurement.

4-3.8 Experience

To date, there have been several hundred life cycle cost procurements using this approach. Many of them have been extremely successful in reducing the life cycle costs of the equipment involved. The grestest area of success has been in procurement of aircraft tires. Currently, almost all aircraft tires are procured in this manner. The records clearly show that, as a result of using this procurement approach, tire vendors have offered higher quality tires at a higher cost, but where the overall life cycle cost benefits have greatly outweighed the additional original cost penalties.

4-4 Design to Cost/Life Cycle Cost Design Trade Study Requirements

4-4.1 Definition

A procurement technique requiring that as part of the overall design effort the contractor conduct studies to assess the cost implication of design and support alternatives.

4-4.2 Description

Design trade studies are a common requirement on most development programs. The overall process of implementing this approach includes requesting offerors to propose design to cost/life cycle cost (DTC/LCC) design trade studies, evaluating these proposals, and contracting for specific trade studies.

As discussed in more detail in Section 4-6.2, an award fee could be paid based on the contractor's performance in carrying out the required and any additional design trade studies used in evolving a low life cycle cost design.

4-4.3 Advantages

This technique for reducing life cycle costs can almost always be applied. In fact, where technology and other uncertainties make it difficult to transfer responsiblity for O&S cost performance to contractors, this approach may prove most advantageous. It also promotes the engagement of government personnel in design decisions affecting O&S costs, where other approaches may tend to promote disengagement.

4-4.4 Disadvantages

This approach does not contractually make the contractor responsible for O&S cost performance as demonstrated in the field.

4-4.5 Selection Criteria

Since this provision can be used with any other type of LCC provision, it can be beneficially used under a wide range of equipment types and program circumstances. It is probably least useful when the design of the equipment to be purchased is firm and there are little or no practical opportunities to alter the design so as to reduce costs.

4-4.6 Guidelines for Application

Determine if there is adequate time and design flexibility to make this a useful approach.

Determine whether the DTC/LCC design trade studies to be involved should be specified by the Government, proposed by the contractors or a combination of both.

Describe all required DTC/LCC design trade studies and any additional provisions for the contractor to propose other trade studies.

Evaluate the proposals with respect to the DTC/LCC design trade study plans presented by each contractor.

Include in the contract Statement of Work a required list of specific trade studies, any requirements for additional trade studies, and documentation requirements for all trade studies conducted.

Assure appropriate Government design specialists and other necessary personnel monitor the contractor's work to assure maximum use is made of the design trade studies to evolve a low life cycle cost system or equipment design.

4-4.7 Special Procurement Documentation

Paragraph 4-4.6 describes the role of the Request for Proposal, the offerors' proposals and the contract Statement of Work in implementing this LCC procurement approach. Appendix D provides a sample provision for an award fee related to DTC/LCC trade studies.

4-4.8 Experience

This approach is being formally implemented on many programs. On the F-16 program an award fee is involved.

4-5 Reliability and Maintainability (R&M) Acceptance Criteria

4-5.1 Definition

A technique used to motivate contractors to produce equipment with low O&S cost characteristics requiring reliability and maintainability demonstration tests which have to be passed before equipment is to be accepted under the contract.

4-5.2 Description

This technique has been adapted as necessary for individual programs. Using reliability acceptance criteria as an example, its essential elements include (1) the specification of a minimum acceptable mean time between failure (MTBF). (2) Specification of environmental and other test conditions. (3) Specification of acceptance test criteria, such as sampling plans, test time, failure definitions. (4) Conducting the tests and arriving at a decision to accept or reject based on the results. (5) In case of rejection, redesigning the equipment and repeating the tests until achieving the results required for acceptance of the equipment in accordance with the specifications described in step (1), (2) and (3). Over the years a variety of test conditions and procedures have been developed and have been put into military standards to define this process.

4-5.3 Advantages

This is a well defined procedure and involves little or none of the uncertainty with respect to how equipment will be used in the field in the future, that complicates other LCC procurement procedures. In addition, this approach separates development and support activities, somewhat simplifying its planning and execution.

4-5.4 Disadvantages

By far the primary disadvantage of this approach is that successful laboratory testing is a necessary, but not a sufficient guarantee that the equipment will demonstrate acceptable reliability in the field. It is difficult to design a test procedure which will correlate MTBF values observed during the tests to those expected in the field.

From an incentive standpoint, this approach is deficient in that it is not directly relatable to resource consumption. The approach discussed in Section 4-6.6 has much in common with this approach and attempts to eliminate these deficiencies.

4-5.5 Selection Criteria

This is a feasible and effective approach in situations where one can assure there is adequate correlation between acceptance test results and field experience, and where time or alternative sources are such that equipment tests can be rejected.

4-5.6 Guidelines for Application

The example procedure description contained in Section 4-5.2 provides general guidelines. Chapter 5 provides considerable guidance in structuring reliability and maintainability programs to reduce life cycle costs.

4-5.7 Special Procurement Documentation

This approach requires that the RFP and contract Statement of Work include very explicit descriptions of test conditions, acceptance test criteria and failure definition.

4-5.8 Experience

Many equipments procured since World War II have been procured on this basis. However, as avionics and other equipment became more complex, more and more reliability and maintainability problems were experienced in the field driving up life cycle costs. Emphasis is now being placed on developing more realistic environmental tests.

4-6 LCC Procurement Incentive Provisions

4-6.1 General

The eight LCC procurement provisions described in this section include contract provisions designed to motivate a contractor to deliver lower life cycle cost systems or equipment. Cost reductions may be sought in support costs, acquisition costs or both. The eight types of provisions represent a spectrum of approaches which can be used individually or in combination to match the LCC reduction motivation needs of new programs. The spectrum includes both incentive provisions already used successfully by the Air Force such as value engineering incentives and award fees, and newer approaches designed to provide more contractor cost reduction motivation, such as support cost guarantees and warranties. There is much less Air Force experience on

these newer approaches. The success of the application of these newer approaches is being closely watched for guidance with respect to when and how best to apply them on future acquisition programs. The discussion of each approach has been prepared in a similar format to assist the reader to compare them and select or develop the approach most appropriate to his program.

4-6.2 Award Fee

4-6.2.1 Definition. A contract provision under which a selected amount of potential fee is set aside and provided to the contractor, based on subjective evaluations made at discrete milestones by the Government, of how well the contractor has performed with respect to reducing life cycle costs.

4-6.2.2 Description. The objective of using the award fee is to motivate the contractor to take action to engage in one or more activity areas, such as design trade studies, more extensive or efficient testing, resulting in eventual life cycle cost reductions. The exact nature and extent of desired activities is left open, with contractor innovation desired by the Government. The two essential parts of all award fee provisions are the maximum size of the fee and the criteria to be used by the Government in make a determination on how much of the maximum possible fee to award. The criteria are very important in that they communicate to the contractor what should be accomplished to earn an award fee.

The incentive fee arrangement used on major system acquisition contracts differs from the usual application of cost plus award fee (CPAF) contracting. The basic purpose of using an award fee feature in system contracts is to direct attention by the highest management levels of the Air Force and industry to contract performance, to maintain their containuing involvement and to provide for communications at high enough management levels so as to facilitate extraordinary results when necessary. An award fee provides added incentive for the contractor's management in that senior Air Force officials periodically will be assessing the contractor's performance and rendering judgements with direct financial impact by means of the award fee process. An award fee evaluation is an "attention getter."

4-6.2.3 Advantages. The primary advantage of life cycle cost award fee incentive provisions is that it provides a mechanism for evaluation of contractor management which usually received secretarial review. An award fee also has the advantage that it is flexible, both with respect to the wide range of criteria which can be used, and because award fee determinations made at some time in the future can be based not only on evidence of the contractor's performance, but on additional information bearing on the difficulty of achieving life cycle cost objectives, not known at the time of contract award.

4-6.2.4 Disadvantages. Many feel and argue that award fee provisions which do not hold contractors responsible for not delivering low life cycle cost equipment as promised, do not adequately motivate contractors. Since award fee provisions are primarily designed to reward a contractor for moving from expected performance to better than expected performance, they may not provide motivation with respect to improving equipment with poor LCC performance. In addition, maximum life cycle cost award fees are generally small compared to the potential operating and support cost reduction opportunities. Some contractors do not like the unilateral aspect of award fee determination procedures and feel good work on their part may not be properly rewarded. Another disadvantage is that award fee boards have to be formally established to make the award fee determinations. This may be time consuming and require the services of already busy high level Air Force personnel.

4-6.2.5 Selection Criteria. The following criteria should generally be applicable before an award fee feature is used:

a. The program involves $50 million or more RDT&E expenditures (DSARC threshold); or for system programs below the DSARC thresold where high Air Force interest or other special considerations are involved.

b. The program is of national importance which requires the highest level of Air Force management involvement in assessing contract performance.

c. Contract performance period exceeds 24 months.

d. The program requires additional incentive to motivate the contractor to achieve above-average overall performance (cost, technical and schedule) and to create an attitude of responsiveness to Air Force needs in an expected dynamic program environment.

e. The program requires added incentive to emphasize certain selected performance parameters unsuitable for objective measurement against pre-determined standards (e.g., associate contractors working toward achievement of common goal, cost of ownership or design to cost).

f. The award fee, when added to all other contract incentives, is defensible as a reasonable total profit commensurate with the complexity and risks inherent in contract performance.

4-6.2.6 Guidelines for Applications. An award fee clause shall be incorporated in a contract as a special provision. This provision shall contain the general areas of evaluation, amount available as an award fee, evaluation periods, and identification of the fee determining official. In addition, it shall contain the requirement for the Government to prepare, and modify as appropriate, an award fee plan.

The clause will state that the fee determined shall be final and is not subject to appeal or "dispute." The clause will set forth that the award fee will be granted for only above "expected" or "average" performance. "Average" performance can only be determined within the context of the particular procurement. The Fee Evaluation Board must assess subjectively such factors as program risks, complexity of work, contractor responsiveness, political or fiscal interventions, program goals and contractor progress to reach a finite award.

Award fee determinations are not appealable under the "Disputes" clause. Accordingly, fairness requires the contractors have an opportunity to present a self-evaluation to the Fee Evaluation Board. Equally important, to insure a maximum degree of equitable and objective consideration in evaluations, the Assistant Secretary of the Air Force (I&L) will normally act as Fee Determining Official and chair the Fee Evaluation Board. He will designate other members as appropriate. Higher echelons of management review and judgements take on broader and more perspective when assessing contractor performance. The location of this Board at the Secretarial or other high Air Force level introduces the application of important factors beyond the program manager's direct interest.

The award fee potential shall be sufficient in value to be more than symbolic but not offering a financial inducement to encourage unwarranted tradeoffs within the contract incentive structure. The amount need only be large enough to distress top contractor management if not earned and to encourage middle management to achieve its award. The total incentive structure, including the award fee, should be tailored to the program and should be defensible within profit guidelines for the type of contract used.

The initial evaluation for award fee purposes shall be performed by the program manager and other front line officials (e.g., AFPRO, IG, DCAA, GAO) and must be subject to a final evaluation and determination by higher level Air Force management officials who are not involved in the day-to-day interface with the contractor. This two-tiered evaluation provides special "checks and balances," both for the Air Force and the contractor, and assures against arbitrary or capricious evaluations. It may also be appropriate and useful to have front line officials other than the program manager present their assessment of the contractor's performance directly to the evaluation board. These presentations and the contractor's self-evaluation should be designed with simplicity as the goal, but should provide a full appraisal of performance as measured against announced objectives.

Fee shall be determined at a point in time late enough in contract performance so as to be based upon performance, but early enough to influence remaining performance. Evaluation will normally

occur no later than 30 days after the end of an evaluation period or completion of a milestone event. The announcement of the fee awarded should be made as soon as possible after evaluation. Timely action is essential to communicate Air Force dissatisfaction and insure corrective action or to encourage continued superior performance. Timeliness is extremely important to maintain the award fee incentive.

As appropriate, evaluation criteria may be adjusted periodically in advance of performance measurement periods to be responsive to what the Air Force determines needs special management emphasis in that particular phase of contract work. These adjustments can be handled in two ways: (1) during the evaluation presentation, the program director recommends changes to the evaluation criteria to emphasize areas requiring greater contractor attention, and (2) the evaluation board suggests criteria changes in the award fee decision document.

Performance evaluation and fee determination shall normally be based on subjective criteria in a minimum number of tailored evaluation areas. The evaluation areas and supporting criteria shall be flexible, realistic, reasonable in number, and relevant measurements of contractor performance in those areas crucial to successful program accomplishment. A substantial degree of subjective evaluation is the essence of an award fee incentive when in combination with other contract incentives. Objective measurements naturally may have their place but they should not predominate. Subjective analysis and judgements applied under a system of checks and balances are valid and in all likelihood will more nearly reflect the total Air Force judgement of the value of the contractor's efforts than do pre-set, inflexible criteria.

Communicating results of the award fee determination to the contractor shall normally be channeled to contractor management through the Program Director. If conditions warrant, the Assistant Secretary, as Chairman of the Fee Evaluation Board, at his discretion may also decide to inform the contractor's top corporate management. The Program Director may be in attendance during this highest level communication or he will be advised on the scope and substance of the Assistant Secretary's remarks.

The minutes of the Fee Evaluation Board shall constitute an executive summary of the proceedings and will be furnished to each board member. The minutes as the decision document, signed by the Chairman, provide authority to the Program Manager to authorize payment of the determined award fee. The minutes also serve as a basis for discussion with the contractor's management of the strengths and weaknesses influencing the Board's evaluation.

The award fee plan shall be prepared by the program office and submitted to the Chairman of the Fee Evaluation Board for approval through appropriate command channels. This plan should be flexible, brief, and concise. It should not require substantial additional recordkeeping or reporting either by the program office or contractor. Preparation and processing the plan will be accomplished to permit furnishing a copy of the plan to the contractor for

information and comment no later than 60 days after contract award. An outline of the purpose and how the award fee provision will operate shall normally be included in the Request for Proposals.

4-6.2.7 Special Procurement Documentation. Execution of life cycle cost award fee incentive provisions does not require special documentation over and above other types of award fee provisions which do not deal with life cycle costing. Appendix D contains two sample provisions. The first addresses a payment provision based to a large degree on the contractor's accomplishments in minimizing logistics support costs. The second addresses a fee based on the results of life cycle cost and design to cost trade studies.

4-6.2.8 Experience. Use of award fee provisions in system contracts has generally been successful. It has been and continues to be a technique in the management of our complex and sophisticated acquisition programs. This is true, not only as to contractor operations, but as regards internal Air Force management. Nevertheless, there should be continuing effort to upgrade and improve practices on a strong base of experience. As this experience is gained, these objectives may require added emphasis, reorientation or new direction.

An Award Fee Incentive provision is incorporated in development contracts on the F-15, B-1, AWACS, A-10, AABNCP, F-16 and other system acquisition programs. The award fee is in addition to cost and, in some cases, performance incentives. The amount available for payment of award fee ranges from $900,000 to $13 million on these contracts. Determination of the award fee is generally based on an after-the-fact subjective evaluation of contractor performance.

The application of an award fee incentive to other than major system contracts may also be appropriate where management is the decisive factor in performance. The award fee technique and process must be tailored to fit the characteristics of these procurement situations.

4-6.3 Support Cost Guarantee (SCG)

4-6.3.1 Definition. A life cycle cost procurement incentive technique primarily characterized by the establishment of a carefully defined logistic support cost target, the determination of measured logistic support costs, based on actual field experience with equipment delivered under the contract, and some sort of contract adjustment based on how well the contractor performed with respect to meeting or surpassing the original logistics support cost target.

4-6.3.2 Description. Support Cost Guarantee (SCG) provisions should generally be used in conjunction with firm fixed price contracts. Support cost guarantee provisions generally have both negative and positive features. When a positive incentive feature is employed, it is provided either as an award fee or price adjustment provision. The

simplest type of price adjustment provision is to pay a higher price for items which have lower support cost characteristics. Award fee provisions are discussed elsewhere in this chapter. The negative incentive feature usually takes the form of one or more of the following type provisions:

a. Hardware Correction of Deficiencies. A provision by which the contractor guarantees that support costs will meet a given target value as demonstrated by verification testing, and that he will correct deficiencies causing this value to be exceeded.

b. Downward Price Adjustment. A provision similar to the hardware correction of deficiencies provision except that the remedy for exceeding the support cost target is a negotiated downward price adjustment either through a reduced fee or a reduced price for a specific production quantity. The schedule for such downward price adjustments must be included in the contract.

c. No Cost Additional Spares. A provision also similar to the hardware correction of deficiencies provision except that the remedy for exceeding the support cost target is that the contractor provides, at no additional cost, additional spares to offset the support cost deficiency.

d. Ceiling Price for Repair. During the period of time required to develop support equipment and data, the contractor can act as the depot and accomplish repair for a unit price per repair. Given a time period, a fixed usage rate and a predictable return rate, a ceiling of the repair cost can limit the cost obligation to the Government.

4-6.3.3 Advantages. Contractor commitments to keep support costs below a specified level are established in the contract. These values are subject to verification and corrective actions by the contractor if not met. Objective and realistic support cost estimates must be made early in the program. The contractor's design effort is forced to direct attention to the supportability of the equipment through the design process. In addition, when support cost guarantee provisions are considered early in development, support cost risks are surfaced at an early date.

4-6.3.4 Disadvantages. Extensive field verification tests involving training, using, acquiring and supporting command personnel are required. The time required to conduct this test may defer contract settlement, closeout, or payment. The expense associated with field verification testing is great and the administrative tasks are many; however, limiting the negative incentive to no cost additional spares can limit the testing to measuring MTBF only. Measuring base and depot labor and material for repair can create significant administrative problems.

When the negative incentive features must be invoked the Government's primary objective has not been met; that is, the contractor did not design, produce and deliver equipment as expected and promised in the contract.

Determining an equitable contract adjustment through either hardware correction of deficiencies, downward price adjustment or no cost additional spares may be a difficult task.

The hardware correction of deficiencies or the no cost additional spares provisions may not be viable options if the production line will no longer be open at the time these options would be exercised.

4-6.3.5 Selection Criteria. The selection of appropriate equipment items on which to use this approach is very important in the application of support cost guarantee provisions. Added administrative expense is involved and must not outweigh the expected cost savings. A good knowledge of the history, characteristics, and state-of-the-art of similar equipment is important. As much information as possible on future use of the equipment is essential. The estimated support cost should represent a significant portion of the estimated life cycle cost. A typical measure is the acquisition to support cost ratio. A ratio no greater than 75/25 will normally be required in order for this approach to be cost effective. In applying this technique to a total weapon system, candidate equipments for possible application of the logistics support guarantee provisions would most likely come from a list of equipments that are projected to constitute at least 30 percent of the total support costs. The AFLC Logistics Support Cost (LSC) model or other like cycle cost models can be used to assess and develop a support cost control equipment selection plan that adequately covers those equipment items which consitute the major components of total support cost. For example, 50 percent of the cost of the Air Combat Fighter can be expected to be accounted for by approximately 10 percent of the total First Line Units (FLUs). Preliminary estimates indicated that the total FLUs of significance would be 200 to 300. Ten percent of this amount would mean that 20 to 30 FLUs would represent approximately 50 percent of the cost. Some estimate of life cycle cost is necessary to determine the relative merits of applying this life cycle cost procurement technique. The criteria listed below may be used for selecting equipment as potential candidates for support cost guarantee coverage.

a. Adequate competition exists or is expected to exist.

b. The equipment must have performance parameters which can be identified in a specification to prospective offerors and, in turn, can be verified by the Government. Without such characteristics, realistic prediction and verification cannot be accomplished. In this connection, a determination should be made early as to whether or not the required and promised performance can be objectively and quantitatively evaluated.

c. The length of time the item is programmed to remain in the inventory is sufficient to warrant the verification testing effort required.

d. Adequate technical and cost data are available or can be made available within the time limitations to enable both the contractors and Government to make reasonably reliable support cost estimates. Government directed mission, design or program changes may impact the target logistics support costs and therefore require changes in the support cost guarantee commitment. Once the contractor is in a sole source position, it may be difficult to negotiate new support cost guarantee terms agreeable to all parties.

4-6.3.6 Guidelines for Application. The support cost guarantee concept should be introduced as early in the acquisition cycle as possible so that the contractors will be motivated to ensure that their equipment's support cost or support cost driving parameters are given appropriate attention at the time the system or equipment is initially designed. Support cost guarantee provisions require carefully defined verification test procedures and clear definitions of failure. In addition, quantitative formulae are required for downward price adjustment and additional spares options based on measured support deficiencies. In applying this technique to a total weapon system, the Government should clearly specify in the Request for Proposal that the equipments to be selected for the guarantee are the top contributors to support costs and that those selected will constitute at least 30 percent of the estimated support costs for all equipments considered.

The AFLC Logistics Support Cost (LSC) model or other similar models can form the initial basis for establishing the cost elements and cost factors that are to be used in the support cost commitment. The applicability of individual elements in the model used should be analyzed to assure each is related to the contractor's responsibility. Based on the results of this analysis, a modified logistics support cost model tailored to the specific procurement should be incorporated into the support cost guarantee clause.

The contractor's proposal should contain a Target Logistics Support Cost (TLSC) proposal with supporting data and rationale using the modified model. A copy of this modified model should be provided to the contractor along with a detailed description to aid in proposal preparation.

At the time of contract award, a TLSC should be established which becomes the cost guaranteed by the contractor under the support cost guarantee.

A verification test must be established to measure the cost factors that will be input to the modified logistics support cost model to arrive at a Measured Logistics Support Cost (MLSC). This verification test should be planned so as to obtain test results prior to production completion, if possible. The MLSC will then be compared to the TLSC to measure the contractor's performance in achieving the TLSC, that is, in fulfilling his support cost guarantee. If the MLSC is less than the TLSC, the contractor is normally eligible to receive an award fee or a positive price adjustment. If the MLSC exceeds the TLSC, the contractor will be required by his support cost guarantee commitment to undertake corrective action. Corrective action requirements must be included in the contract and can take several forms:

For the negative price adjustment option, a quantitative formula for repricing based on support deficiencies must be developed and clearly specified in the contract.

For the no cost additional spares option, a quantitative formula must also be developed to define precisely the number of additional assets, e.g., spares, that must be provided to correct the deficiency. The contract should clearly state that Government approval is required before additional assets are provided by the contractor. This is because the situation might be such that the contractor could not meet his support cost commitment because of unnecessarily complex and costly support equipment, lack of built-in test capability, excessive access time, and other such deficiencies that are not directly correctable by providing additional spares. A method for fixing the unit price of additional spares should be provided in the contract.

Provisions should be included in the contract which will allow an assessment of the impact on the TLSC of Government initiated changes prior to the Government directing implementation of such changes. The provision should allow for negotiation of the change and establishment of a new TLSC. Quantifying the impact on the TLSC can provide a criterion for making a cost-benefit assessment of each change prior to approval or disapproval.

Changes in the TLSC may also be required to account for inflation, changes resulting from the Government's decision to depart from the maintenance concept that was assumed in the calculation of the baseline TLSC and changes in the anticipated force structure or activity rates.

4.6.3.7 <u>Special Procurement Documentation</u>. Because support cost guarantee provisions must be tailored to the item or equipment selected, standard SCG clauses are not feasible. However, Appendix A has been prepared to provide a considerable amount of "how to" guidance. This appendix contains (1) a list of essential elements which should be considered, (2) guidance on where these elements may

appropriately be incorporated into the standard Request for Proposal format (AFSCP 70-4), and (3) a sample of procurement documentation, if appropriate. These samples are provided for information and guidance only and to illustrate the degree of detail that may be necessary so that potential offerors will have a clear and precise understanding of what is required and the procuring activity will have proper information for source selection evaluation and contract definitization.

4.6.3.8 Experience. Several procurements are underway which are using logistics support guarantee provisions. The Aeronautical Systems Division is using this procurement technique on the ARC-164 and it and other LCC procurement techniques on the F-16 program. The Electronic Systems Division is using logistics support cost guarantee provisions on the ARN-101 Program. Warner Robins Air Logistics Center used a "no cost additional spares" negative incentive for the VOR/ILS program based on operational test and recomputation of initial spares and projected recurring spares.

4-6.4 Reliability Improvement Warranty (RIW)

4-6.4.1 Definition. A Reliability Improvement Warranty (RIW) is a fixed-price contractual provision employing inherent incentives for reliability and maintainability enhancement with a contractual commitment for repair or replacement of all covered failures during the specified coverage period of three to five years.

4-6.4.2 Description. The objective of an RIW is to motivate contractors to design and produce equipment which will have a low failure rate, as well as low repair costs after failure, resulting from operational use. In general, an RIW will provide for the repair or replacement of failed units as well as agreed to no cost engineering changes and the associated calibration, adjustment and testing. RIW is not, however, a maintenance contract, and RIW provisions will not require a contractor to provide routine periodic upkeep, i.e., adjusting, cleaning, replacing fuses or light bulbs, or normal on-aircraft maintenance. An RIW does not cover components of a warranted item that are replaced under normal use during the term of the warranty. Such items may be identified and provided for by separate provisions in the contract consistent with current laws and regulations, but they should not be included in the RIW provisions.

Improvement in reliability of equipment included in an RIW will normally be accomplished through the mechanism of "no cost" (to the Government) Engineering Change Proposals (ECPs). Processing of these ECPs shall be consistent with Government requirements for maintaining configuration control. Once a fixed price is established for the warranty, the level of profit realized by the contractor is dependent upon the equipment's demonstrated reliability and maintain-

ability in service use, which in turn is influenced by any improvements that he can make in its reliability and maintainability, to reduce the rate of returns for repair and the cost of such repair thus maximizing his profits.

RIW has been used in the commercial environment and is currently being used on a trial basis within DOD as a means to control a portion of life cycle costs. Other LCC techniques should be used when the program does not meet the major criteria outlined in paragraph 4-6.4.5.

4-6.4.3 Advantages. Under RIW, the contractor has a degree of financial responsibility for field performance of his hardware. The contractor no longer may seek lowest acceptable reliability and his interest in reliability achievement and enhancement is maintained after production as he can still make changes that favorably influence support costs. The contractor achieves maximum profit by controlling and making appropriate tradeoffs between production costs and certain operating and support costs.

An RIW ties the responsibility for product performance success directly to the supplier's profits, not only at qualification and acceptance testing, but also for field operation.

The Government can defer many initial logistics decisions concerning the purchase of spare parts, test equipment and technical data. These decisions can then be made based upon more and better information generated during RIW. Recurring training and support equipment maintenance can be avoided during the RIW.

When an RIW approach is properly considered early in development, support cost risks are surfaced at a time when they can best be addressed and costs avoided.

4-6.4.4 Disadvantages. It may not be practical to estimate with any degree of accuracy the warranty costs for many new items of equipment having any significant technical complexity.

Laboratory controlled reliability demonstration tests along may not provide a sufficient basis for developing a reasonable estimate of expected field reliability and reliability growth protential.

The most important fact affecting the economic outcomes of an RIW is the rate of return of units to the contractor's plant. A prediction of this factor must be based on known or estimable data in order to identify and control risk. This factor is significantly influenced by how the equipment will be used in the field. Use and environmental conditions must be clearly defined at the time of warranty pricing. This information is often not available. However, some uncertainty on use and environmental factors can be reduced through contractual provisions, e.g., adjustment for usage rate.

Applying an RIW to a nondepot overhaul type of equipment introduces additional logistics problems, longer pipeline, increased spares and potentially greater overhaul costs. This may be offset by the use of contractor personnel at field locations if the number of locations are not prohibitive.

Government directed changes may impact the contractual agreement and could require renegotiation or negate the RIW firm fixed price contractual arrangement.

For new equipments, the decision whether or not to implement an RIW must be made early enough to permit orderly maintenance support planning by the contractor or the Government and will probably occur when limited test data is available to assess the merits of the RIW approach.

Configuration tracking is necessary to enable the retrofit to a single configuration at the conclusion of the warranty. This is necessary for AFLC is to assume organic maintenance at the conclusion of the RIW and to preclude a variety of configurations in the field at that point. A potential problem is user resistance to pulling good units to send back to the contractor for retrofit, or increased Air Force costs if the contractor provides kits and the Air Force installs the kits.

4-6.4.5 Selection Criteria. The major criteria for the application of a Reliability Improvement Warranty are:

a. Field reliability, cost to support the equipment, and potential for reliability growth will be reasonably predictable at the time offerors must make firm fixed price bids.

b. Terms of the RIW be tailored so that the rewards and risks to both industry and Government are acceptable.

The level of risk is significantly influenced by (1) whether the equipment is evolutionary, (2) the availability of test data (at the time of bid) on which to base cost and reliability estimates, and (3) the ability of the Government to provide the contractors with reasonable projections of mission, environment, and expected utilization.

There are a number of other criteria which should be satisfied for an item to be selected for Reliability Improvement Warranty coverage. They are listed below:

a. A warranty can be obtained at a price commensurate with the contemplated value of the warranty work to be accomplished, with consideration being given to the contractually specified reliability and maintainability requirements and goals.

b. Moderate to high initial support costs are involved.

c. The equipment is readily transportable to permit return to the vendor's plant or, alternatively, the equipment is one for which a contractor can provide field service.

d. The equipment is generally self-contained, is generally immune from failures induced by outside units, and has readily identifiable failure characteristics.

e. The equipment application in terms of expected operating time and the use environment are known.

f. The equipment is susceptible to being contracted for on a fixed price basis, with competition on the basis of form, fit and function stimulated to the extent practicable.

g. The contract can be structured to provide a warranty period of from three to five years. This should allow the contractor sufficient time to identify and analyze failures in order to permit reliability and maintainability improvements.

h. The equipment has been sufficiently developed so that reasonable estimates of expected reliability and maintainability can be made, and the equipment has a potential for both reliability growth and reduction in repair costs.

i. Potential contractors indicate a cooperative attitude toward acceptance of an RIW provision and evaluation of its effectiveness.

j. A sufficient quantity of the equipment is to be procured in order to make the RIW cost effective.

k. The equipment is of a configuration that discourages unauthorized field repair, preferably sealed and capable of containing an Elapsed Time Indicator (ETI) or some other means of usage indication.

l. There is a reasonable degree of assurance that there will be a high utilization of the equipment.

m. The equipment is one that readily permits the contractor to effect no-cost ECPs subsequent to the Government's approval.

n. Failure data and the intended operational use data can be furnished the contractor for the proposed contractual period and updated periodically during the term of the contract.

4-6.4.6 Guidelines for Application. The RIW concept may be introduced to some degree at any point during the acquisition cycle. Normally, the maximum benefit can be expected by including such RIW contract provisions at the time of award of the initial production contract for the system/equipment. For new equipment, the Government should indicate to prospective contractors early in the development cycle that it plans to consider such a warranty provision for inclusion in the contract at the time of initial production approval. By so doing, contractors will be motivated to ensure that their equipment's reliability and maintainability are given appropriate attention at the time it is initially designed.

An analysis should be performed for each new proposed warranty application in order to determine whether or not the use of an RIW would be cost effective. Such an analysis should investigate the relative cost of the RIW and non-RIW situations (including ECPs) and examine the cost of varying time periods. Use of an RIW will usually involve additional costs over and above the acquisition cost and such cost increments will increase with the length of the warranty period. The determination as to whether or not an RIW provision is cost effective should be made prior to utilization of this contractual technique. An analysis can be accomplished prior to incorporating such a provision in the RFP. If an RIW approach appears feasible based on this analysis, it may be included as an option in the RFP. Upon receipt of the contractor's proposal, a detailed analysis will be required. In order to make an accept/reject decisions as to the use of an RIW provision, the actual price proposed by the contractor for the RIW must be known. If the contractor provided a single proposal for equipment with an RIW, it would be extremely difficult to determine how much of the proposal price was attributable to hardware and how much to the RIW. It is, therefore, important that the contractor be required to separately price the RIW provision so that a comparison may be made with the Government's cost estimate.

Application of an RIW does not have to be limited to procurements that are merely repackaging of previously fielded equipment. It can be applied to any new equipment, even if the design utilizes new technology and there is no previous field experience. What is important is that adequate development time and testing be scheduled to support reasonable cost and reliability estimates prior to the time the firm fixed price bids must be made.

The greatest value of an RIW contract provision is expected to be realized in the initial years of the equipment's field deployment. To assure a smooth transition from contractor support under the RIW provision to an organic support position by AFLC, the Government should consider acquisition of the contractor's support data generated from the RIW experience.

The amount and scope of the initial contract warranty should take into consideration the uncertainties of future support costs and the risks to both contractor and Government. This period of warranty coverage generally should continue for three to five years or at least three overhaul cycles through a contractor's facility.

A fixed price for the RIW coverage will be agreed upon during negotiation of the production of equipment overhaul contract. The warranty will also be established as a separate contract line item. In the case of formally advertised contracts, the terms of the warranty and a separate priced contract line item must be included in the Invitation for Bids.

RIW programs shall be funded from the same appropriation as the production or overhaul contract containing the RIW. The RIW cost is part of the fixed price contract, and payment to the warrantor for the RIW portion shall not be made in a manner different than payment under the remaining portion of the contract, except that payment for the RIW may be delayed until delivery or relinquishment of control of the item by the warrantor.

In order to maintain the important distinction between an RIW and a service contract covering normal periodic maintenance, the following requirements must be satisfied:

a. The RIW will be included in a fixed price contract for the production or overhaul of an item or items.

b. The warranty period on each item will begin after manufacture or overhaul, upon delivery, or after the warrantor relinquishes control of the item.

c. The RIW will require the warrantor either to repair or replace at his option the warranted item upon failure.

d. The RIW will not include requirements for the warrantor to provide removal or replacement at the flight line or normal upkeep, cleaning, adjusting, regulating or other periodic on-equipment maintenance which would be required without respect to failure.

e. The RIW will exclude components of the warranted item which, under normal circumstances, will require replacement under normal use during the term of the warranty (such as filters, light bulbs, fuses, etc.). These items are normally replaced by Air Force base level personnel if this will not violate the conditions of the warranty. However, intermediate level and depot level maintenance accomplishment by the contractor requires replacement of components which are anticipated to fail during the warranty period.

4-6.4.7 Special Procurement Documentation. Because RIW provisions must be tailored to the item or equipment, selected standard RIW clauses are not feasible. However, Appendix B has been prepared to provide a considerable amount of "how to" guidance. This appendix contains: (1) a list of essential elements which should be considered, (2) guidance on where these elements may appropriately be incorporated into the standard Request for Proposal format (AFSCP 70-4), and (3) a sample of procurement documentation. These samples are provided for information and guidance only and to illustrate the degree of detail that may be necessary to that potential offerors will have a clear and precise understanding of what is required and the procuring activity will have proper information for source selection evaluation and contract definitization.

4-6.4.8 Experience. Experience to date by various Air Force organizations includes:

ASD, F-111 Gyro (implemented with operational experience indicating beneficial results)

ASD, F-16 (contract option, not yet implemented)

ASD, C-141 AHRS (on contract but not yet implemented)

ASD, AUV-8C/A Airspeed Indicator

ESD, TACAN (on contract but not yet implemented)

AFLC, C-141 INS (on contractor but not yet implemented)

AFLC, C-130 Hydraulic Pump

AFLC, Klystrom Electronic tube

4-6.5 Reliability Improvement Warranty (RIW) with MTBF Guarantee

4-6.5.1 Definition. Under an RIW with a Mean Time Between Failure (MTBF) Guarantee, the contractor has all the responsibilities of the basic RIW with an additional warranty that a specified operational MTBF for his equipment will be achieved.

4-6.5.2 Description. The objective of an RIW with an MTBF guarantee is to provide a life cycle cost control approach assuring the Government of obtaining the MTBF maturation through the guarantee provision. Projected MTBF maturation is contained in the contract as a function of time over the warranty period. If the specified operational MTBF is not achieved, the contractor is required to provide

additional spares to support operations and may be required to submit corrective engineering change proposals and implement approved changes at his expense.

Since this coverage is also provided under a fixed price contract, the contractor has an inherent incentive to improve the MTBF. In addition, the contractor must absorb costs under the negative incentive feature if the guaranteed MTBF is not achieved.

4-6.5.3 Advantages. In addition to those advantages listed for RIW, the contractor may be required to make his design, redesign and corrective action decisions so as to achieve his guaranteed MTBF. Therefore, the Government should get equipment with not only lower support costs but with increased mission reliability and increased availability.

Although inherent in the RIW concept is an indirect incentive for MTBF achievement, the MTBF guarantee provides direct relief in the form of consignment spares for shortages within the logistics system resulting from low MTBF. The RIW and MTBF guarantee are totally complimentary.

4-6.5.4 Disadvantages. The final design configuration should be stable and the Statement of Work and specifications developed to provide the capability to define, measure and predict the MTBF and its growth during the warranty coverage. This is often not possible at the time when the acquisition is still in a competitive environment if only one full scale development contractor is involved.

The Statement of Work and specifications are often more complex than RIW and other types of incentive provisions.

The contractor's price will often be greater than the RIW alone since his cost exposure risk is increased. Government administration cost will be greater in that accurate use and failure data must be kept to determine exactly what the MTBF value experienced in the field is for each of the several incremental periods covered in the warranty.

Should spares be determined using early MTBFs of low value, excess spares may exist upon attaining a higher level of MTBF. Excess spares may also exist in the maintenance concept when it is converted from two levels to three levels at the completion of the warranty period.

4-6.5.5 Selection Criteria. The criteria for selecting equipment as potential candidates for RIW with MTBF guarantee coverage are essentially the same as for normal RIW. However, since MTBF values must be specified, it is even more critical that the equipment be

sufficiently developed so that reasonable estimates of expected reliability can be made and that reliability growth can be predicted in accordance with the measurement periods specified. For the MTBF guarantee option to be feasible, it must be possible to establish a method of measuring operating time, such as the use of Elapsed Time Indicators (ETIs). It is therefore important that the Statement of Work and specification can be developed to provide the capability to define, measure and predict the MTBF at the level of warranty coverage. In addition, since this is a more expensive approach than RIW alone, these added costs should be justified by the value to the Government of actually achieving higher MTBF values.

4-6.5.6 Guidelines for Application. When the MTBF guarantee is handled as a rider to an RIW the same guidelines apply. In addition, plans must be made and agreed upon in negotiating the contract for determining the MTBF values covered in the MTBF guarantee. Clear definitions of failures, time and MTBF computations must be provided.

4-6.5.7 Special Procurement Documentation. The same elements of procurement documentation discussed in Appendix B for Reliability Improvement Warranty (RIW) are applicable to the RIW with MTBF Guarantee. However, it is important to separately identify the MTBF guarantee option whenever the RIW is discussed. Just as the RIW provisions must be tailored to the item or equipment, the same is true of the MTBF guarantee provisions. Appendix C does provide a sample of procurement documentation for information and guidance only and to illustrate the degree of detail that may be required.

4-6.5.8 Experience. Experience to date by various Air Force organizations includes:

ASD, F-16 (contract option not yet implemented)

ASD, C-141 AHRS (option included in contract)

ESD, TACAN (on contract but not yet implemented)

Warner Robins ALC (AFLC), C-141 INS

4-6.6 Reliability Demonstration Incentive

4-6.6.1 Definition. A procurement which includes a provision paying the contractor for a variable price per unit depending on the reliability of the equipment demonstrated under a specified set of test chamber conditions.

4-6.6.2 Description. A recent study* indicated that current

* Avionics Reliability Study, AFSC/XRX.

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reliability test procedures led contractors to design to the minimum acceptable reliability, and when they didn't achieve it, continually correct the equipment until it came up to the minimum acceptable standard. Often equipment was accepted without meeting desired standards to meet schedule objectives. The study suggested that it would be much more desirable from the Air Force standpoint if the contractors would attempt from the outset to design equipment significantly with better reliability than the minimum acceptable level so that either better than expected equipment would be delivered or there would be some margin for unexpected problems, which often occur and which, in the past, generally degraded reliability. In a reliability demonstration incentive type of life cycle costing procurement, a bonus fee schedule will be prepared based on the reliability of the equipment demonstrated under specified conditions. This approach primarily differs from other life cycle cost incentive provisions in that the basis for incentive provision settlement determinations is Government specified and closely monitored test chamber, not field, reliability demonstration testing.

4-6.6.3 Advantages. The primary advantage of this life cycle cost procurement technique is that it gets directly to the root of many operating and support cost problems, low reliability equipment. It has the advantage over some LCC procurement techniques in that it requires the demonstration and assessment of only one parameter, that is, equipment reliability as opposed to several parameters required to assess total equipment life cycle costs. In addition, it places considerably fewer obligations on the Government and over a much shorter period of time. The net result should be that contracts of this type would be considerably simpler to plan, negotiate and execute than many other life cycle cost procurement techniques which involve the use of logistic support cost targets and extensive field tests and data collection procedures to determine how well these targets were being met.

4-6.6.4 Disadvantages. One disadvantage is that this incentive is tied only to reliability and does not include consideration of other factors which affect life cycle costs, such as time to repair, spares consumption, required maintenance skill levels, etc. Another disadvantage is that historically there has been poor correlation between reliability test results conducted at the contractor's facility and reliability demonstrated in the field. This approach cannot work effectively unless this problem is substantially corrected.

4-6.6.5 Selection Criteria. The most important provision selection criterion is to assure that reliability alone is the predominant factor affecting the life cycle cost of the equipment in question. It is also important that it be determined that equitable procedures can be agreed upon to make the final assessment of the

reliability of the equipment delivered by the contractor. Equipment that would require working in conjunction with other pieces of hardware not produced by the same vendor, and where in the field it would be difficult to identify exactly which piece of equipment was initially responsible for a failure, could be a prime candidate upon which to apply this type of LCC procurement procedure.

4-6.6.6 Guidelines for Application. There are five major steps in applying this LCC procurement procedure. The first is careful screening and selection of equipment to be procured in this manner. The second step is the development of an appropriate bonus schedule for the delivery of higher than minimum MTBF or reliability equipment. This schedule should be based on the savings that will accrue to the Air Force in operating and support costs because of the improved reliability. The third step is the development of the test plan with which to assess the reliability of the equipment. This will involve testing a sample of the total quantity equipments over a limited time period. Test conditions, sample sizes and reliability determination procedures should be carefully worked out prior to any testing. A critical factor in the success of this LCC reduction procurement approach is to assure that equipments that perform well, i.e., have a high MTBF, in the test program, will perform well in the field. To assure this, attention must be given to making sure the testing conditions are representative of the environmental and use conditions the equipment will experience in the field.

The Fourth step is conducting the reliability assessment tests and arriving at an estimate of the delivered equipment reliability and determining if the equipment met the minimum MTBF requirements. The fifth step is to use the demonstrated reliability data and the payment schedule previously specified to determine the amount of bonus the contractor should receive. This bonus schedule should be such that it shares between the Government and the contractor, the operating and support cost savings that would be realized if equipment with higher than the minimum specified value is delivered.

4-6.6.7 Special Procurement Documentation. There are two special contract documentation items. The first is the schedule of how the price paid by the Air Force for the equipment will vary as a function of the reliability demonstrated by the equipment in the field. This price adjustment must be based on the amount of operating and support cost savings the Air Force will realize by the delivery of higher reliability equipment. Reliability improvements can significantly reduce operating and support costs. Therefore, it is anticipated that payment of even a small fraction of these savings to the contractor will provide a significant incentive for him to design and deliver higher reliability equipment.

The second item of special contract documentation important in this kind of life cycle cost procurement approach is the test plan for assessing the demonstrated equipment reliability. It is important that this plan be prepared in such a way that it accurately assesses the reliability value that the Air Force can expect from use of this equipment under a broad spectrum of conditions over the lifetime of the system. However, as a practical matter, the demonstrations will have to take place under a set of conditions that can be accurately described to the contractor.

Forecasting what actual conditions will be and designing an equitable set of demonstration conditions may be a difficult task. However, there is considerable margin for error when one realizes that, in the past, very often the demonstrated reliability of equipment in the field has been on the order of ten percent of that originally anticipated based on test chamber reliability test results. In addition, considerable progress has been made recently in improving the correlation between chamber test and field experience reliability data.

4-6.6.8 <u>Experience</u>. Oklahoma City ALC (AFLC), AN/GRC-171 transceiver.

4-6.7 <u>Fixed Priced Repair with Incentive</u>

4-6.7.1 <u>Definition</u>. A repair contract under which the contractor will be paid a fixed amount per item to repair each item that fails in a specified time or a ceiling amount, whichever is less. The contractor is given a share of the savings if the total cost of the repairs is less than the ceiling.

4-6.7.2 <u>Description</u>. The objective of a fixed priced repair incentive contract is to control support costs by obtaining unit repair cost prices in a competitive environment, and motivating the contractor to achieve the reliability used as a basis for the unit repair cost prices and the contract repair cost ceiling.

4-6.7.3 <u>Advantages</u>. The Government can obtain fixed commitments on repair costs while suppliers are still in competition. Objectivity and realism in support cost estimates submitted for source selection consideration are enhanced. The contractor incurs a lower cost exposure risk than he might incur on an RIW contract. He can generate a continually updated data bank on the field performance of his equipment which puts him in an excellent position to enter into a follow-on RIW contract.

4-6.7.4 <u>Disadvantages</u>. There is no guarantee that reliable and maintainable equipment will be delivered. Contract repair often requires additional pipeline spares and the associated costs. There

is less incentive for the contractor to improve the reliability of the equipment than on RIW contracts. There may be time when forecasting the field reliability is difficult and therefore arriving at an equitable ceiling price may be difficult. Cost effective application of this approach is generally limited to items normally repaired at a depot and where the expense of the added pipeline spares costs are not prohibitive.

4-6.7.5 Selection Criteria. A fixed priced repair contract with incentive is applicable to some depot level reparable items for which there is a reasonable basis for predicting the maintenance cost and failure rate. Items may be selected for this approach when organic maintenance is not practical and interim contractor support is planned and other life cycle cost reduction techniques are less appropriate.

4-6.7.6 Guidelines for Application. Plans to use this approach and the associated responsibility of the contractor should be included in the Request for Proposal. Bids, including prices should be obtained while there is still competition. Plans must be made for follow-on support after the initial repair contract. Government obligations to provide information and more units, etc., should be clearly defined. Contractor response times and other responsibilities must be clearly defined. The issue of pricing the average repair and pricing different types of repairs must be addressed.

4-6.7.7 Special Procurement Documentation. No special contract documentation is required other than that needed to address the guidelines described in paragraph 4-6.7.6.

4-6.7.8 Experience. This approach has been considered for several programs but has not yet been used.

4-6.8 Design-to-Cost (DTC) Incentives

4-6.8.1 Definition. An incentive arrangement used to motivate the contractor to introduce producibility and supportability considerations into his design, suggest configuration changes which can reduce cost without seriously reducing mission performance capabilities, and to recommend the elimination of performance requirements or specifications which do not provide system capabilities commensurate with their costs.

4-6.8.2 Description. Currently most design to cost targets are tied to production costs. A design to cost incentive in a production contract is a fixed priced incentive agreement generally using specified formulae for establishing the earned level of profit.

The formula would base the target profit on the achievement of the specified design to cost target. The formula may have positive and negative incentive features. It is applicable to design to cost targets that can be quantified and measured, such as a unit or cumulative average unit production cost target for a specified buy quantity produced at a specified rate per month.

4-6.8.3 Advantages. A design to cost incentive can increase contractor's profits while decreasing Government costs. An innovative contractor should be able to achieve design to cost objectives without degrading performance. Use of DTC incentives can provide a means of motivating the contractor to reduce costs when competition no longer exists. They also provide a means of cost control in procuring the first production quantities. They better assure contractor's design efforts give proper attention to producibility.

4-6.8.4 Disadvantages. Control and visibility over nontarget related costs must be rigorously maintained to preclude actions reducing target related costs while increasing nontarget related costs. For example, use of low reliability parts could reduce production cost while greatly increasing operating and support costs. To preclude situations such as this, operating and support cost targets should be established. This approach requires the continual tracking and assessing of the cost target which will be affected by directed design changes, escalation and many other factors. When Government directed changes may impact the agreed to target, a new target must be negotiated in a noncompetitive environment.

4-6.8.5 Selection Criteria. In addition to the profit incentives to control costs, design to cost incentives provide another means of providing a profit incentive to contractors as a means of obtaining extra management attention and effort to surpass the targets. The key element is the ability to measure achievement of the parameters which are incentive oriented and the structuring of all incentives to achieve a balanced incentive program consistent with the overall life cycle cost objectives of the program. If competition does not exist, some type of incentive to properly motivate the contractor to achieve the design to cost target is warranted.

4-6.8.6 Guidelines for Application. The contract should be structured to require and motivate the contractor to introduce producibility and supportability considerations into his design, suggest configuration changes which can reduce cost without seriously reducing mission performance capabilities, and to recommend the elimination of performance requirements or specifications which do not provide system capabilities commensurate with their costs. Since

the full scale development phase usually does not involve parallel contracts and the resulting competition, it is in this phase that maximum consideration should be given to contractual means of motivating achievements of design to cost targets.

The nature of the incentive arrangement and the size of the incentive should be determined on the basis of its purpose in the overall acquisition strategy. If the strategy is to rely primarily upon competition and tradeoffs in the advanced and full scale development phase to achieve the design to cost targets, then the use of design to cost incentives will normally be unwarranted. If competition does not exist, then the contract should contain some type of incentive to properly motivate the contractor to achieve the design to cost target. One such arrangement would be an award fee, for example, CPIF/AF. An award fee arrangement is particularly useful in establishing targets and assessing how well they are met. Award fees were discussed earlier in this chapter. If the target can be established based on a single objective, an incentive pattern of a firmer type contract, for example, CPIF, may be used.

Another alternative, particularly for production cost targets, is a variation of the fixed price incentive formula (FPI) type of contract. Under this arrangement, development could be performed under cost-type contracts, but with a specified formula for establishing the profit. This formula would base the target profit of the production contract on the achievement of the design to cost target and the required performance in the development contract. The formula would reward the contractor with an incentive payment if the design to cost target is achieved or bettered. A negative incentive feature can also be provided if the contractor does not meet the design to cost target. The agreed to formula should address the application of progress or learning curves, the effects of tooling, labor mix changes, forward pricing rates, adjustments for inflation or any other factor that is of significance to the particular program.

One approach that may be pursued should competition exist, would be to provide an incentive fee based on the actual unit production cost compared to the unit production cost proposed during development.

4-6.8.7 Special Procurement Documentation. Implementation requires the development of a special design to cost incentive provision. Essential elements that must be addressed include:

a. The definition of the design to cost target including the cumulative average production unit cost, the components and cost make-ups and production rate and initial production quantity.

b. The amount of added incentive fee and the conditions for earning the fee, including the successful demonstration of the requirement of the specification and the demonstrated cumulative average production cost.

c. The agreed upon production unit cost curve.

d. The incentive sharing arrangement and the target profit, and profit limitations (for both positive and negative incentives).

e. Provisions to adjust for inflation.

f. Provisions to provide for an equitable adjustment in the unit production cost for design or other approved changes. Cost reduction changes originated and submitted by the contractor that would reduce the system cost in production, and accepted by the Government, should not result in adjustment to the target cost values used to determine the design to cost incentive fee.

g. Provisions for renegotiations due to changes in requirements.

The contract change proposal provision must be tailored to address the processing of changes related to the design to cost incentive. Particular emphasis must be given to the submittal and Government assessment of life cycle cost estimates for all design to cost or other design changes.

4-6.8.8 <u>Experience</u>. Experience to date by various Air Force organizations includes:

ASD, B-1 ECM

ASD, C-5 Wing Modification

ASD, EF-111A

ESD, OTH 414L

4-6.9 Value Engineering Incentive

4-6.9.1 Definition. A value engineering incentive contract provisions permit the contractor to share in cost reductions that would result from change proposals they initiate.

4-6.9.2 Description. The objective of value engineering incentives is to encourage the contractor to submit cost reduction proposals involving some change in the contract specifications, purchase descriptions, or contract statement of work. This may include the elimination or modification of any requirements found to be in excess of actual needs in areas such as design of components, materials requirements, material processes, tolerances, packaging requirements, technical data requirements, or testing procedures and requirements. Furthermore, even when the contract cost may be increased, the incentive provisions encourage contractors to submit engineering change proposals that are likely to lead to overall savings resulting from significant net reductions in collateral costs of Government furnished property, operational requirements and logistics support requirements.

Additional information on value engineering contract provisions is contained in the Armed Services Procurement Regulation, Section I, Part 17, "Value Engineering." Value engineering is the overall effort directed at analyzing each contract item or task to ensure that its essential function is provided at the lowest overall cost, that is, lowest life cycle cost. It is the Department of Defense policy:

a. To provide contractors with a substantial financial incentive to undertake value engineering on the premise that both DOD and the contractors will benefit. Accordingly, the contractor should be assured (1) a fair proportion of the savings, (2) that his proportion will apply to a substantial base, and (3) objective and expeditious processing of proposals submitted.

b. To encourage subcontractor participation through extension by prime contractors value engineering incentives to appropriate subcontractors.

Unlike several of the new types of life cycle cost provisions, value engineering incentive payments related to O&S cost reduction related proposals are based on estimated savings rather than field experience with the specific equipment.

Value engineering incentives in full scale development contracts are one management tool for reducing production and operating and support costs. However, precautions must be exercised to prevent possible duplication between value engineering incentives and other life cycle cost incentives. Special contractual language may be required to address the issue of multiple incentives.

4-6.9.3 Advantages. Value engineering provides a management mechanism and tools to motivate contractors to challenge unnecessary requirements and thereby reducing life cycle costs. This in turn can provide an opportunity to involve each manager, engineer, and technician in cost reduction activities as part of his responsibilities for meeting performance and schedule requirements.

Value engineering techniques can be applied to a wide range of programs. Prime contractors can use them to encourage subcontractors to reduce costs.

Value engineering provisions have a relatively short evaluation period prior to incentive payment thereby increasing the contractor's motivation. Their administration is relatively simple compared to techniques requiring a lengthy assessment of O&S cost performance based on operations in the field.

4-6.9.4 Disadvantages. Valid assessment of operating and support cost reduction implications of changes is often difficult and may involve considerable uncertainty. Value engineering may not be an adequately strong incentive to reduce future costs.

4-6.9.5 Selection Criteria. Armed Services Procurement Regulation, Section I, Part 17, "Value Engineering," provides guidelines for the selection and use of value engineering incentives. In general, it is the policy to include a value engineering incentive clause in all supply and service contracts of $100,000 or more, and may be included in contracts under $100,000 if the contracting officer foresees a potential for savings. Exceptions provided in ASPR are as follows:

a. This clause shall not be included in

(1) contracts for research or exploratory development.

(2) contracts for engineering services from "not-for-profit" organizations.

(3) cost reimbursement type contracts other than cost plus incentive fee or cost plus award fee type contracts.

(4) contracts for architect-engineering services.

(5) contracts containing a value engineering program requirement clause except when this clause is restricted to well defined areas of performance under the contractor. In this situation, a value engineering incentive clause should be included for the remaining requirements of the contract.

(6) contracts providing for product or component improvement unless the value engineering incentive clause application is restricted to areas not covered by provisions for product or component improvement.

(7) contracts for commercial items being procured without invoking special military requirements and specifications.

(8) contracts for personal services.

b. This clause may be excluded from the following when determined in writing by the contracting officer that its inclusion would be in conflict with other contract requirements and objectives:

(1) contracts for advanced development or engineering development.

(2) cost plus incentive fee or cost plus award fee type contracts.

c. This clause may be excluded from contracts or classes of contracts of $100,000 or more when the Head of the Procuring Activity (HPA) determines that there is minimal potential for cost reduction through value engineering.

4-6.9.6 Guidelines for Application. ASPR, Section I, Part 17, "Value Engineering" provides guidelines for application. However, precautions should be exercised to prevent possible duplication between value engineering incentives and other life cycle cost incentives. This problem may require appropriate modification to the basic clauses outlined in ASPR. For design and development contracts with design to cost features the future acquisition sharing portion of the value engineering incentive clause should be modified in accordance with the following guidelines:

a. If the contract has a production unit cost target requirements, but no incentive in this regard, it may be desirable to share future VECP savings only on the amount that the achieved unit production cost is lower than the target unit production cost.

b. If the design to cost requirement is incentivized, care should be taken to insure that no duplication in incentive awards exists, before sharing any future VECP savings.

In order to provide increased visibility to operating and support cost implications of proposed design or program changes, supplemental guidance to the contractor may also be required in addition to that contained in the ASPR.

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4-6.9.7 Special Procurement Documentation. ASPR 7-104.44 provides (a) a value engineering incentive clause to be inserted in firm fixed price contracts, fixed price contracts with economic price adjustment or fixed price contracts providing for prospective price redeterminations, (b) a sharing provision to be used in fixed price incentive (firm target) contracts, (c) a sharing provision to be used in fixed priced incentive (successive target) contracts, and (d) methods for sharing future acquisition savings.

4-6.9.8 Experience. Value engineering incentives have been used successfully in numerous contracts. Recent emphasis on life cycle cost procurement techniques including design to cost incentives has raised concerns regarding contractor submission of cost reduction proposals which require contract change in full scale development contracts. The concerns relate generally to the manner in which the Government seeks to incentivize submission of such change proposals. Assistant Secretary of Defense (I&L) guidance recognizes that while no one solution may fit all individual contractual situations, use of the value engineering clause provides a full range of contractor motivations and therefore deserves serious consideration.

Chapter 5

Reliability and Maintainability Programs and Their Relationship to Life Cycle Cost Procurement

5-1 Introduction

5-1.1 General

In any given procurement, there are many elements or factors that contribute to the quantification and assessment of life cycle costs. Many of these elements will be biddable items; such as, unique support equipment, unique facilities, new technical data, training and the unit cost of the equipment itself. However, the projection of recurring operating and support cost are often a function of reliability and maintainability as well as important design, operational and support planning factors. Many life cycle cost procurement techniques rely on the establishment of life cycle cost targets based on reliability and maintainability parameters, which are subject to final operational verification. This requires the imposition of realistic requirements which are contractually enforceable. This also requires a well managed reliability and maintainability program with all decisions affecting any contractual requirements made only with insurance that the life cycle cost commitments will not be invalidated. The following sections discuss important aspects of reliability and maintainability programs and considerations that may impact life cycle cost and/or life cycle cost procurement contract provisions.

5-1.2 Reliability

From the mission point of view, reliability is usually thought of as the probability that a system, subsystem, or equipment will perform a required function under specified conditions without failure for a specified time. This is normally defined as "mission reliability" and is expressed as a decimal fraction (e.g., 0.92, 0.90, 0.85). It is important to understand that mission reliability has no meaning unless associated with a specific mission profile. On the other hand, support personnel may think of reliability as a measure of how often repair or spare parts are required. This is usually referred to as hardware reliability and expressed as Mean Time Between Failure (MTBF). To be standard, the Air Force has defined MTBF as equipment operating time divided by the number of malfunctions confirmed by subsequent maintenance activity. A common approach to improving mission reliability is to add redundant or standby components. This approach increases the complexity of the system and may appear to the maintenance man to cause a reduction in hardware reliability and an increase in life cycle costs. The planning, design, and development of a new system must consider all aspects of reliability. AFR 80-5 provides the policy and direction for implementation of a reliability program as part of the acquisition process. The essence of this program is the evolution of reliability

goals into contractual requirements, analysis of engineering design, selection and control of component parts, failure reporting and analysis throughout DT&E, a responsive corrective action system, demonstration of contractual requirements, and final operational verification.

5-1.3 Maintainability and Maintenance Engineering

Maintainability is simply a measure of the ease with which something can be fixed or checked over. More formally, it is defined as a characteristic of design and installation expressed as the probability that an item will be restored to (or retained in) a specified condition within a given time using certain procedures and tools. The "retained in" case usually refers to preventive maintenance. A typical maintainability specification might say, for example, that 90 percent of all failures must be repaired in less than 15 minutes using certain test equipment, tools, spare parts and personnel and also that the average or mean time to repair (MTTR) will be five minutes. With these two parameters, a corresponding maintainability demonstration test can then be selected to determine whether the equipment meets those requirements. While maintainability is a characteristic of the design, the maintenance required is a more inclusive term that is also affected by nondesign related functions such as maintenance management policies. Maintenance engineering is the activity of developing maintenance concepts and criteria to ensure adequate and economic support of weapons and equipment. Maintainability is largely determined by the overall configuration of the system or equipment and is pretty much fixed by the end of full scale development. The job had better be done right by that time, because retrofit changes to enhance maintainability during production and deployment are extremely expensive and disruptive. Maintainability is an attribute directly linked to the manual skills of people and to logistics planning for maintenance and support.

5-2 Contract Requirements

The reliability and maintainability (R&M) program policy as related to contract requirements emphasizes the need to make R&M program plans of potential contractors a significant factor in source selection actions, especially as they impact system and cost effectiveness. Contract incentives in terms of performance guarantees for reliability, maintainability, system effectiveness, and life cycle costs, are also to be used when the minimum acceptable requirements and demonstration plans are sufficiently defined to permit a clear measurement of contractor performance. Guidance is contained in Chapter 4 and the DOD Incentive Contracting Guide, AFP 70-1-5.

This policy states that contracts for advanced development of hardware including advanced development prototypes shall: (a) include numerical hardware R&M design objectives; (b) require an analysis of all failures to determine the failure mode and the probable cause, with

feedback to design activities, and; (c) require an update of R&M predictions, based upon engineering analysis and data obtained from test programs. If the prototyping effort is planned to lead directly into production, the prototyping contract will establish numberical R&M requirements which must be demonstrated. In these cases, AFR 80-5 and MIL-STDs 785 and 470 are to be followed.

When the developmental effort is directly related to program advocacy and obtaining approval of an acquisition program, each phase described below is to contain a requirement for contractor R&M programs extending through the subcontractor levels.

a. During the conceptual phase, R&M characteristics and operational or support constraints are to be considered in tradeoff studies and quantitative R&M objectives are to be established. These objectives may be modified in later phases, but must be established during the conceptual phase. Reliability may be expressed in terms of mission reliability, hardware reliability (or both), and as a requirement or as a goal. Regardless of how they are expressed, these reliability values are to be considered as objectives that must be refined and confirmed, or possibly changed by detailed system analysis. The analysis must show the effect of reliability on operational effectiveness, the feasibility of achieving the desired reliability, and the expected impact on life cycle costs. Like the reliability program, the identification of realistic maintainability requirements is critical. Initial goals and objectives should be established by the operating command; however, these goals must be flexible and should be considered negotiable by everyone concerned in the early phases of development. Too stringent a requirement (repair time too short) will require sophisticated fault isolation methods with attendant cost, weight and perhaps reliability problems, and may unnecessarily complicate design of the package for quick teardown and assembly. It can also lead to approaches that merely transfer the repair problem to a remote facility with a possible increase in total repair time and other support costs.

b. During the validation phase, quantitative R&M values are to be specified. These values may be specified as design objectives when preceding studies and operational constraints cannot adequately define minimum acceptable and technically achievable values. These values are to be refined and firm requirements established before the full scale development phase begins. Demonstration of these values is not mandatory during the validation phase; however, R&M predictions, analysis of R&M data from all testing, and determination of R&M deficiencies and necessary corrective action are to be performed, documented and carried forward to the full scale development phase for update and corrective action. A reliability evaluation test (that is, a test to determine reliability deficiencies rather than to demonstrate achievement of specified values) may be required and be advantageous to the Air Force in the validation phase.

c. In the full scale development phase, the contract documentation is to include comprehensive R&M programs in accordance with MIL-STDs 785 and 470. The RFP for this contract may contain a range of acceptable R&M values, so that the potential contractors may propose on various levels within that range. The contract award may then be made at the level most favorable to the Air Force provided that the source selection criteria defines the basis for the award. In any event, the final contract is to contain numerical R&M requirements which must be demonstrated before production begins.

d. In the production phase, the contract for production items (including reprocurement of equipment and components whose R&M have been demonstrated and found adequate) is to include, as a minimum, the same R&M values for the production equipment and is to require periodic verification of reliability during production runs. Successful R&M demonstration is to be a condition of acceptance. If the R&M parameters of the existing equipment have been found inadequate, the procurement data will be revised to reflect the required improvement. Major R&M deficiencies are to require a special program for improvement and demonstration.

e. In the production phase, the procurement of an existing item which did not have prior R&M requirements imposed but which has demonstrated satisfactory operational R&M characteristics, need not contain provisions for specific requirements; however, the contract is to contain provisions to assure that demonstrated R&M characteristics are not degraded. R&M provisions in these cases must be approved by the R&M focal point of the organization involved. The supporting rationale will be documented in the contract file.

When procurement is based on vendor technical and engineering data alone, this data must provide assurance that the R&M performance parameters are adequate for the intended application and are controlled for uniformity. Generally, when an off-the-shelf aircraft or item of aeronautical equipment is being procured that has been certified for airworthiness under the Federal Air Regulations, civil operations will be assessed as a basis for procurement. Complex commercial or off-the-shelf equipment, whose functions affect safety or mission accomplishment is an exception. Two such exceptions are as follows: (1) equipment which was not certified to operate under conditions as rigorous as are envisioned for its USAF use; or (2) uncertified equipment when vendor technical data is inadequate as determined by the Air Force engineering personnel.

Each contract schedule should allow sufficient time for satisfactory demonstration of the minimum acceptable R&M parameters of hardware involved.

Each contract for system development and acquisition should include only the minimum essential data requirements upon which R&M control, visibility and management decisions can be based. The standard data items developed for these purposes are in the DOD authorized data list (DOD-ADL). However, these should be tailored to each application.

For a major weapon system, the procuring activity, with the aid of the appropriate contract management agencies (such as the Air Force Plant Representative Office), maintains surveillance over the contractor's R&M programs. For other than a major system, the contract administration activity maintains surveillance over the contractor's R&M programs, and therefore must provide feedback to the procuring activity on contractor performance. However, in the surveillance of any contractor R&M program, the procuring activity may obtain support from any Air Force activity that has the pertinent technical capability, or from a technically qualified contractor (if no conflict of interest is involved).

During full scale development phase, repair level analysis should be performed in accordance with AFLCM/AFSCM 800-4. This analysis may be performed earlier -- as a preliminary study -- but, if so, it should be updated during the full scale development phase.

The total cost for the delivery of a ready and operationally effective system is to include the cost of achieving R&M. Each change in the original scope of the R&M effort must be validated by a system cost effectiveness analysis that encompasses the total life cycle of the system.

5-3 Reliability Prediction and Verification

5-3.1 Scope

Reliability prediction and verification are particularly important in life cycle cost procurements. Special attention must be given to: (1) development of a sufficient specification; (2) development of guidelines to be followed by offerors in predicting the reliability of their hardware; (3) assessment of the reasonableness of the offerors' predictions and alternative reliability requirements, and; (4) procedures to be specified by the Government and utilized by the contractor for verification of reliability predictions. Where feasible, these verifications should be accomplished in a controlled test environment which simulates the operational conditions under which the hardware will subsequently be operated by the Government. This section provides guidelines in these areas.

5-3.2 Reliability Measurement

The reliability and related demonstration requirements that are to be incorporated in a life cycle cost procurement contract must be sufficiently defined to permit a clear measurement of contractor performance. This entails the following action:

a. Specify the reliability characteristics of the item, such as mean time between failure, mean time to failure, mean wearout life or mean cycles between failure.

b. Define what constitutes a failure.

c. Prescribe prediction methods.

d. Specify the techniques that will be utilized by the Government to assess the reasonableness of the contractor's predictions.

e. Prescribe a statistical test plan.

f. Prescribe the environmental profile that will be used for the acceptance test.

g. Stipulate the time phasing and sample size of the test.

If the test is to be performed in an actual controlled operational test environment, the following considerations are also important:

a. The method of sample selection (e.g., proportional to production rate).

b. The means of measuring usage (e.g., flying hours or operating hours).

c. Source of measurement (e.g., AFM 65-110 reporting or elapsed time indicators (ETIs)). If ETIs are not used and there is a significant ground to flying hour differential, provisions for accounting for this differential should be provided.

d. How reliability maturation will be considered in test results if appropriate for the selected equipment.

e. Provisions for ensuring sufficient test hours with specific attention given to producer's risk.

f. Selection of representative test vehicles and provisions for selection of representative number of each type of test vehicle and expected usage.

g. Selection of representative test sites.

h. Demonstration of who will accomplish the test (e.g., Air Force maintenance personnel), how they will be selected and trained and whether or not they will be certified by the contractor.

i. Procedures for the maintenance, installation and removal of test samples including provisions to allow the contractor to witness maintenance actions.

j. Definition of test failures including exceptions for "acts of God."

k. Procedures for failure verification.

l. The frequency of review meetings to be attended by the contractor and specified representatives from the Government to review test procedures and results; and procedures to investigate and resolve contractor/Government disagreements on issues such as failures or maintenance questions.

m. Forms and procedures for data collection and reporting.

n. An explicit definition of what constitutes the start and completion of the test.

o. The formulae for verification calculations.

5-3.3 Reliability Testing Program

There are many reliability program management actions that must be taken to ensure adequate reliability measurement. This section discusses several management areas that can significantly affect reliability. In a life cycle cost procurement special attention must be given to this area particularly as it affects the Government's obligations.

a. Reliability testing must be given adequate priority. As the development program progresses, it is important that the relative priority of reliability testing be maintained. One or more equipments should be allocated to reliability testing. It is important to ensure that this equipment is retained for reliability evaluation testing and not used for other testing, as has often been the case in the past.

b. It may be desirable to delay the start of formal reliability testing and conduct an informal reliability evaluation test to "work out the bugs" on complex equipment. This is particularly important if there is growth in equipment complexity as the design progresses. Failure rates generally increase as the number of parts and components increase.

c. Design problems and design iterations create pressures to delay reliability testing until the design stabilizes. This has often resulted in reliability testing not being completed prior to the end of production.

d. Adequate attention must be given to reliability test facilities and the necessary support equipment and instrumentation. Inadequate attention in the past has often resulted in procurement delays, support equipment calibration delays and insufficient support equipment backup.

e. Adequate attention must be given to obtaining reliability test facilities and ensuring their use for reliability evaluation. In the past reliability test facilities were used for other tests or shared with other tests often impacting the reliability test program.

f. Attention must be given to timely availability of reliability test procedures. Particular attention must be given to preventing delays for the following reasons: design changes, negotiating definitions of relevant failures and other ground rules, nonavailability of basic equipment operation and performance testing procedures or debugging and proofing the test procedures.

g. Tight delivery schedules can impact reliability testing in a number of ways. The priority given to meeting a delivery schedule has in the past resulted in delivery of items of equipment without their scheduled amount of reliability testing and without the successful completion of the reliability tests. An accelerated development program also creates manufacturing and acceptance test problems. These problems are compounded by delays in receiving material to manufacture the equipment. Whenever equipments fall behind schedules, reliability testing on early equipments are delayed usually with the rationale that reliability testing can be made up on later equipments. When reliability testing is accomplished using a reliability test sample the distribution of reliability test hours is important and should not be compromised because of schedule constraints.

Reliability tests should not be expected to produce 100 percent successful results, therefore; the contractual documents must also address unsuccessful reliability testing. In this regard the contractual documents must clearly define the responsibilities and financial obligations of the contractor, provisions that address corrective actions and provisions for retesting.

Environmental qualification testing and environmental qualification evaluation tests are also important tools in a reliability program. Whenever feasible environmental qualification tests should be structured to validate all dependent equipment (LRUs/FLUs) in one test chamber and interconnected in a manner identical to actual equipment operation.

Reliability programs require time and money, both of which are scarce resources to a program manager. However, the cost of unreliability is high. The cure is reliability engineering. It is therefore extremely important that reliability programs be given sufficient management attention. Reliability programs are usually a pacing factor in a program schedule and as a result of the desire to reduce the development time, initial reliability programs are success oriented. As problems begin to surface, reliability programs deteriorate at the expense of other program objectives. In a life cycle cost procurement, decisions impacting the reliability program require careful deliberation including the impact on the Government's ability to fulfill its obligations under the contract and the contractor's liability.

5-3.4 Reliability Prediction

Each offeror should be advised that his proposal must include a reasonable rationale supporting the attainability of his proposed MTBF. Each offeror should also be advised of available procedures that may be useful. Examples of these procedures are: MIL-STD-721, MIL-STD-756, MIL-STD-781, MIL-STD-785, MIL-HDBK-108 and MIL-HDBK-217. Each offeror should be advised that the application of these techniques is not a sufficient basis for acceptance of the predicted values and that each offeror is expected to present a convincing case in support of his proposed MTBF or service life. While these guidelines are general and may appear to be of limited value, strict compliance with published procedures is not practical since these procedures are heavily oriented to electronic type equipment. If a prediction methodology cannot be selected for a given type of equipment, considerable dialogue between the Government engineering staff and the offeror's engineering staff will be required to assess the credibility of each offeror's proposed MTBF.

5-3.5 Definition of Failure

Unless failures are defined accurately, a contractor may will be able to pass the most stringent reliability acceptance test with substandard equipment. Failures are generally defined in MIL-STD-781. The definition is of a general nature, and MIL-STD-756 recognizes the need for clearly defining failure in a unique way for each item that will be subject to a reliability acceptance test. Therefore, the Statement of Work for each acquisition program must tailor the description of equipment failures to the specification and failure modes of the equipment in question. The definition of a failure is only possible through a sufficient understanding of the equipment failure mechanism. One very difficult point that must be covered is the discrimination between operator adjustment and failure correction during the reliability acceptance test. Another is the discrimination between independent and dependent failures and the degree to which exclusion of

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dependent failures will be permitted. Still another difficulty arises in stipulating what will be done in the event pattern failures occur during the reliability acceptance test. There is no single or simple answer to defining failures adequately. Different definitions of failure may be required for special LCC provisions and LCC verification tests. A discussion of various values of MTBF of interest in life cycle cost procurement is contained in the following paragraphs.

The first value of concern is the minimum acceptable MTBF which is included in the specification of the equipment being procured. This value should be established based on its intended usage in the field. The specified MTBF is sensitive to the operating usage in the field. If it is practical to conduct a reliability measurement test utilizing an environmental profile that, in fact, simulates operational conditions, then the value of this MTBF should be incorporated in the specification as the minimum acceptable MTBF. If this is not practical, an appropriate adjustment should be made to this MTBF value to compensate for expected variations between the controlled test and the actual operating conditions. Unfortunately, no specific guidance can be provided to facilitate this adjustment. Such adjustments can be made by scaling historical data utilizing the judgement of the engineering staff. This minimum acceptable MTBF should serve as the basis for evaluating the responsiveness of each offeror as well as a basis for contract termination or adjustment. One approach is to use a clause which requires the contractor to implement corrective changes to the equipment at his own expense.

The next value of MTBF of interest is the proposed MTBF which is a value that each offeror should propose as a target MTBF to be used in a postaward reliability acceptance test.

To retain management visibility over the status of the reliability program so that timely corrective actions can be initiated, a method must be devised to ascertain at any given point in time just what a given MTBF should be. A set of MTBF milestones could be established and subsequently tracked. These milestones should indicate what percentage of the target MTBF is to be expected at that point in time. It may be possible to incorporate some form of contract incentive based on the achievements of the MTBF target ahead of schedule.

The final value of interest is the measured MTBF determined through a post award verification test. This post award assessment will then be used to implement life cycle cost procurement techniques such as, logistics support cost commitment or price adjustment provisions. These life cycle cost procurement techniques are discussed in Chapter 4.

5-4 Maintenance Concept

The maintenance concept is a statement of the general policy, ground rules, and overall approach to achieving the operational requirements. The concept includes such things as: projected availability of maintenance facilities or equipment at field, base, or depot; the skill levels to anticipate for maintenance personnel; the feasibility of contractor maintenance support and at what locations; the necessity or desirability of using standard test equipment in the field or at the depot; the kinds of transportation assumed to be available from the field to base or depot; and anticipated transportation hazards. The concept also describes the general approach to maintenance envisioned from the operational requirements, the operational mission, and the logistics or maintenance ground rules and supporting rationale. The contractor should be asked to evaluate this concept for equipment design studies, maintainability analyses, and life cycle cost analyses.

5-5 Maintainability Programs

5-5.1 Maintainability Analysis

This includes several kinds of analytical efforts performed by development contractors, all for deriving the best approaches to detailed equipment design and maintenance procedures. These analyses strive to find the design configuration and maintenance procedures that will satisfy operational requirements within the agreed to ground rules of the maintenance concept at the lowest life cycle cost. These trades may lead to recommended changes in the requirements and the overall maintenance concept. Maintenance analysis is accomplished by applying subjective judgements based on practical experience supported by various analytical procedures. Three specific analytical procedures included in maintainability and maintenance analysis are described in the following paragraphs.

a. Level of Repair Analysis (LORA). This is an analytical procedure for finding the most cost effective maintenance and logistic support philosophy. It considers factors such as the cost of repairing a failure at the operational site versus the depot and the cost of discarding a failed module versus repairing it. Inputs needed are reliability predictions, equipment design options, and equipment cost estimates.

b. Maintainability Apportionment. Maintainability apportionment or allocation is analogous to reliability apportionment and is the analytical method by which a system maintainability requirement is distributed or allocated to subsystems, subassemblies, and components. It requires inputs from a reliability prediction, and is performed by the system contractor to establish numerical maintainability requirements for his subsystem designers, subcontractors or suppliers.

c. Failure Modes Analysis. Failure modes, effects and critical analysis (FMECA) determines the effects of a failure on a system or equipment, including chain reaction failures. In maintainability engineering, it helps establish failure detection logic, test points, and test procedures, which in turn affect equipment design, test equipment requirements, maintenance procedures and technical manuals.

5-5.2 Design for Maintainability

The task of designing for maintainability consists of defining specific hardware layout and packaging configurations that will implement the design guidelines derived through maintainability analyses. This task addresses the details of hardware design such as module configuration and arrangement, choice of built-in failure indicators, electric cable layout, connector selection, fastener selection and placement, tubing layout, circuit board layout, access panel placement, test point selection and access, grease fitting placement, materials selection for ease of maintenance, design for safety and other human factors. General guidelines to good design practices are in MIL-STD-470. More specific guidelines for electronic equipment design are in the AFSC Design Handbooks DH 1-8, Microelectronics, and DH 1-9, Maintainability. Design guidelines and requirements for all equipment classes are in standard military design specifications for those specific classes. Included are consideration for materials that will meet operational requirement tolerances while being receptive to later corrosion control efforts. Similarly, access design provisions must be able to accommodate nondestructive inspection (NDI) of interior structural component integrity. The results of this detailed design work may lead to a reevaluation of the maintainability requirements, the maintenance concept, and the maintainability analyses. Design is part of the maintainability iteration cycle which must result in a fixed configuration by the end of full scale development.

5-5.3 Maintainability Prediction

This is an analytical effort performed by the system designer. These predictions estimate the mean time to repair (MTTR) of the system or equipment and show the potential of a certain design for meeting maintainability requirements. Initially, these predictions will be based on estimates from contractor experience with certain equipment layouts, but as design progresses, the predictions will become more reliable as specific maintenance details evolve. MIL-HDBK-472, Maintainability Prediction, describes methods that may be used. These predictions should be evaluated for reasonableness based on Air Force experience wherever these estimates are used in life cycle cost estimates.

5-5.4 Maintainability Verification

A maintainability demonstration is accomplished at the end of full scale development. Test procedures are in MIL-STD-471A, Maintainability Verification/Demonstration/Evaluation. Maintainability

demonstrations may use failures simulated by introducing faults into the system and the times observed to repair the simulated faults. Using this technique, a maintainability demonstration for a complex system may be extremely time consuming and the results questionable because of the difficulty of predicting and simulating faults that may be encountered in the field. Intermittent failures, for example, cannot be easily simulated and these are extremely troublesome to repair. Hence a maintainability demonstration using failures occurring during normal equipment operation is a much better measure of actual equipment maintainability. Unfortunately the time required to obtain a statistically valid number of sample tasks may be prohibitive. Therefore, the approach to maintainability verification must be determined on an individual equipment basis. Verification of maintainability parameters for reasonableness in a life cycle cost procurement will be required for source selection and in any post award life cycle cost verification test.

5-6 R&M Considerations in Special LCC Provisions

Contractual R&M quantitative requirements are related to contractor controlled aspects of R&M. This must be recognized when using R&M measurements to track and evaluate life cycle costs. The R&M parameters for LCC provisions should be consistent with the definitions/criteria contained in AFR 80-5.

The main source of R&M data is from contractor predictions or estimates until prototype or preproduction test data becomes available. Due to cost constraints, detailed supporting data or analyses (i.e., computer simulations) are rarely provided. Therefore, justification to refute the contractors' predictions or estimates is rarely available. In such cases, it is questionable whether the contractor has the incentive to provide realistic predictions, especially if there is a contract penalty involved. For these reasons, caution must be taken in applying LCC commitments during early full scale development that require R&M parameter verification.

Many of the LCC provision options (i.e., RIW) must be exercised at the time of the long-lead decisions. Usually this occurs during the time of subsystem testing and almost always before system testing. Consequently, there is rarely any R&M test data available when the key options must be exercised. This must be recognized when formulating the contractual LCC provisions.

MIL-STD-781 is intended for the demonstration of contractual reliability design requirements for electronic subsystems/equipment. Testing is conducted under controlled definitions, criteria, and

conditions. Most test plans are based on short-term, sample testing. The testing demonstrates how "bad" the reliability is (i.e., greater than an MTBF minimum requirement) not how "good" the reliability is. In this light, the applicability of this type of testing to LCC provisions is limited.

MIL-STD-471 is intended for the demonstration of contractual maintainability design requirements. As with MIL-STD-781, the testing is controlled and often of the short-term, sample nature. Due to schedule constraints, the tasks demonstrated are often based on simulated faults in lieu of natural occurring failures. The maintainability demonstration/testing is constrained by the delivery of support equipment and technical orders. A majority of the MIL-STD-471 test plans are based on certain prior assumptions as to the statistical distribution of maintenance tasks. As with MIL-STD-781, many of the test plans demonstrate how "bad" the maintainability is (i.e., less than a specified MTTR requirement) not how "good" it is. Therefore, the applicability of this type of testing to LCC provisions is also limited.

The first program testing that approaches a realistic environment for measuring R&M parameters is the system testing using preproduction equipment. Even in this testing, some support equipment, technical orders, and production configured subsystems are not available which limits a complete system R&M measurement. In addition, schedule constraints may limit the amount of quantitative data, especially at the lower indentured equipment levels. These considerations along with the dynamic nature of system testing (test program/schedules inevitably change after contract award) must be considered when formulating the LCC provisions.

Many of the LCC provisions require the Government to provide the contractor failure/maintenance data from operating activities. To meet the intent of the LCC provisions, the contractor requires detailed engineering data to initiate R&M improvements/corrective actions. Although existing data systems provide failure/maintenance occurrence data, it is questionable whether the existing data systems provide the engineering data (failure symptoms/cause, failure modes, specific corrective tasks) to meet the contractor requirements. Contractual requirements to verify R&M parameters during actual operation must consider the procedures of how the verification will be accomplished.

One of the major problems with any R&M test/demonstration is what to do if the contractor does not meet the requirements. It is usually assumed that the contractor can come up with corrective redesigns to bring the R&M up to specified requirements. This is not always true, especially when a program is in the later stages of development. Catastrophic failures (component failures) usually are not the problem.

Inevitably, it is "cannot duplicate" or intermittent failures which cause the problem for which a simple corrective action other than major redesign is not always available. Such results often strain the best of R&M and LCC requirements when evaluated against other program constraints. This must be recognized, especially when growth requirements are imposed on a contract.

Chapter 6

Program Documentation and Its Relationship to Life Cycle Cost Procurement

6-1 Introduction

The major planning and action documents used in the acquisition process are the statement of Required Operational Capability (ROC); the Decision Coordinating Paper (DCP) or the Program Memorandum (PM); the Program Management Directive (PMD); the Program Management Plan (PMP); the Advanced Procurement Plan (APP); the Source Selection Plan (SSP); and the Request for Proposal (RFP) and contract. Subsequent paragraphs will discuss the purpose of each document, design to cost and life cycle cost issues and where applicable, supporting life cycle cost activities.

6-2 Required Operational Capability (ROC)

The acquisition process may begin with the statement of operational deficiency or need and the maintenance concept. This statement may be expressed by HQ USAF or the major command as a ROC. A mission analysis or other study is usually accomplished to identify new concepts for the system or equipment and provide supporting data for preparing the ROC. Analyses are also used to clarify issues during the review and validation of the ROC. Key life cycle cost activities include preliminary reliability, maintainability and life cycle cost studies that result in establishing cost effective operational concepts, a maintenance concept and proposed levels of maintenance, preliminary support concepts, system availability requirements, and reliability and maintainability requirements and goals. The ROC and supporting studies and analyses therefore provide important considerations in determining the acquisition strategy and procurement documentation. Reference: AFR 57-1 and AFR 66-14

6-3 Decision Coordinating Paper (DCP)

The DCP supports the DSARC review and the Secretary of Defense decision-making process throughout the acquisition life cycle of a major program. HQ USAF integrates the AFSC inputs with the material prepared by other commands and the Air Staff into a draft DCP for Secretary of Air Force review and signature. The DCP is prepared before DSARC I and is updated before each succeeding DSARC. It is the principle document for recording (1) the essential information on a program including the issues and risks, the alternatives, decision rationale and review thresholds and the phasing of funds, and (2) the Secretary of Defense decisions. It includes a section on the acquisition strategy, design to cost goals and life cycle cost estimates. The

program manager is responsible for many of the inputs to the DCP and as such the procuring contracting officer is responsible for assisting in preparing the acquisition strategy inputs. This strategy should only be modified if the corresponding technology advancement originally assumed is not borne out during development, or if major changes in program approval are determined necessary. Reference AFR 800-2, Attachment 4

6-4 Program Management Directive (PMD)

The PMD is a brief HQ USAF statement of requirements for a new program. A PMD for the conceptual phase will indicate what USAF and Secretarial actions have been completed and what the program manager must accomplish to translate the requirement into a proposal for the new program. USAF specifies DTC and LCC requirements in this document.

PMDs will also be provided by USAF for subsequent full scale development and production phases as more information becomes available.

It is noted that under a new memorandum of agreement between HQ AFSC and HQ AFLC, AFLC will assume a review and advisory role in processing of PMDs. This procedure should prove valuable since an early review by those responsible for definition of field support cost factors should improve LCC planning and implementation. HQ AFSC establishes the program priority and issues guidance and direction (AFSC Form 56). References AFR 800-2 and AFSCP 800-3

6-5 Program Management Plan (PMP)

This plan, constructed in parallel with the Advanced Procurement Plan (APP), is the principle management baseline document for the program. Unless otherwise directed, it is approved by the program manager and furnished to higher authority for information and such control as may be reserved by higher authority. This plan:

a. Reflects a management approach most appropriate to the peculiar program established to implement PMDs and AFSC Forms 56.

b. Outlines the total program planning, events, schedules and resources required for program efforts specified in the PMD and AFSC Forms 56.

c. Serves as the singular baseline management document used by all participating organizations and provides them with essential and current program objectives, requirements and other responsibilities, tasks, and time-phasing actions related to each organization.

d. Contains those section set forth in AFSCP 800-3, Attachment 3.

The PMP should reflect agreement with the APP on the goals and expected achievements of the life cycle cost procurement technique and how life cycle costing is to be implemented. This statement should coincide with direction provided in the PMD and AFSC Form 56 or explain why the proposed approach is considered more advantageous. Plans for developing a contractor incentive program, balancing life cycle cost and other objectives, should be addressed. Life cycle cost procurement techniques discussed in Chapter 4 should be evaluated as well as any other alternative that has the potential of influencing the contractor to reduce life cycle costs. How relative life cycle costs associated with each contractors' design will be determined and considered in source selection, should be addressed. Guidance on developing and preparing a program management plan is contained in AFSCP 800-3. Reference: AFR 800-2 and AFSC Supplement 1 thereto, and AFSCP 800-3

6-6 Advanced Procurement Plan (APP)

This plan is the principle long range procurement planning document which charts the course of major procurement programs. Advanced procurement planning includes consideration of operational requirements, technical objectives, economic factors, use of appropriate contract techniques, and compliance with procurement regulations and policies. The specific method of life cycle cost procurement application will depend upon the acquisition strategy and related decisions. These were discussed in earlier chapters and the selected approach must be documented in the APP. If it is determined that a life cycle cost procurement approach for the specific acquisition is not appropriate the rationale for nonuse must be documented in the APP. Reference: ASPR 1-2100 and Air Force and AFSC Supplements and; AFR 800-11

6-7 Source Selection Plan (SSP)

The SSP is the key planning document for initiating and conducting the source selection process. This plan includes the following areas critical in evaluating life cycle costs:

a. Screening criteria. This criteria should include a requirement that the sources selected will have the management, financial, and technical capability necessary to design and produce a logistically supportable system.

b. Evaluation Criteria. The evaluation criteria to be included must be tailored to the specific aspects of the program which are vital and significant to the selection decision. It should address the known areas of risk and uncertainty and life cycle cost driving parameters. An indication should also be provided of the relative importance of each criterion for later use in the solicitation.

c. Evaluation Procedures. The evaluation and rating methodology to be used by the Source Selection Evaluation Board (SSEB) and the Source Selection Advisory Council (SSAC) analysis technique should be described.

d. Evaluation of Costs. Those items of the system for which costs will be evaluated should be identified. Those items that are considered to have sufficient cost impact to warrant special consideration should be separately identified. Items that are cost related and have an economic impact on the program, but which are not quantifiable should also be identified. Plans for using and developing an independent cost estimate should also be presented. Steps to be followed in formulating the Government's best estimate of the total cost to the Government should be outlined including the methodology, scope, and data to be used and how it will be used in evaluating the offerors' proposals. Provisions must be addressed for evaluating any life cycle cost incentives, warranty or guarantee options.

e. Procurement Approach. Included in the procurement approach is a schedule of the significant procurement actions required during source selection to accomplish definitive contracts. Included are the type of contract(s) proposed, incentives contemplated, milestone demonstrations intended and special contract clauses to be used, such as, life cycle cost provision and reliability improvement warranty provisions.

Additional guidance with respect to life cycle cost procurement implications on planning source selection activities is contained in Chapter 7. Reference: AFR 70-15 and AFR 70-6

6-8 Request for Proposal (RFP) And Contract

RFPs and contracts for the conceptual phase should specify objectives for production and operating and support cost or major operating and support cost drivers, but need not specify rigid goals which would prevent optimum tradeoffs between unit cost, performance, quantities desired, and overall affordability. RFPs and contracts for the validation phase and full scale development phase should consider the factors listed below. The procuring contracting officer should ensure that these factors are considered in the RFP or contract or that valid reasons exist for their absence.

a. Production and operating and support cost objectives or goals or the surrogate operating and support cost driver variables, such as reliability and maintainability (R&M) requirements.

b. Production quantities, production rates, and learning curves.

c. Methods for handling inflation or deflation.

d. Methods for handling changes impacting the contractual DTC goals. These could be of DOD origin due to mission changes or major changes in requirements, or contractor originated. Care should be taken to encourage contractors to submit cost effective changes. ECPs should be priced out on a life cycle cost basis to the extent possible.

e. Incentives, if any, and methods of verification. This includes operating and support cost considerations as well as production unit cost (PUC).

f. Reporting requirements, frequency, and Work Breakdown Structure (WBS) depth.

g. Schedule and technical requirements flexibility.

h. Subcontract requirements.

i. Any special tooling, directed subcontracting, or directed or permitted use of Government facilities.

j. A statement that the contract does not commit DOD to production.

k. Source selection criteria.

l. Contractor identification or areas of high risk.

m. Contractor data needed to substantiate estimates of production cost, operating and support cost or surrogate operating and support cost driver variables.

n. Contractor information on proposed program to manage production unit cost and operating and support cost or operating and support cost driver variables.

(1) Organization

(2) Goal segmentation and depth

(3) Proposed estimating and reporting systems

(4) Methods of feedback to designers

(5) Internal change control system

(6) Plans to extend cost or reliability and maintainability goals to subcontractors.

o. If the contractor is to prepare operating and support cost estimates or operating and support cost incentives are planned, include the following:

(1) Mission scenarios

(2) Logistics concepts

(3) Operating concepts

(4) The operating and support cost model to be used

(5) Definitions of model terms

(6) Contractor and DOD responsibilities for data inputs to the model.

(7) If operating and support costs are to be verified by analogies to current systems or subsystems, a data base of reliability and maintainability, personnel and other cost related parameters of analogous items should be provided. The contractor should then be required to rationalize changes from existing equipment and related resource requirements.

p. Conditions of any Reliability Improvement Warranties (RIWs) or Logistic Support Cost Guarantee provisions to be used.

It is DOD policy to control actual production cost by use of design to cost management philosophy. Production contracts following full scale development should have a separate line item for the design to cost items to (1) prevent assignment of relevant production costs to cost elements not covered by the DTC goal, and (2) to serve as a measure of performance against any development contract DTC incentives. Value engineering incentives will be employed in accordance with Part 17 of ASPR. Reference: AFSCP 70-4

Chapter 7

Source Selection

7-1 Introduction

The purpose of this chapter is to provide general guidance for the planning and execution of source selection and related procurement activities in a manner which will better achieve life cycle costing and design to cost objectives. The guidance is primarily directed at validation and full scale development phase source selections.

Effectively using source selection activities to reduce costs involves the coordination, planning and execution of a spectrum of activities. These activities are discussed in paragraphs 7-2 through 7-4. Paragraph 7-2 addresses the need to clearly establish what role life cycle cost/design to cost (LCC/DTC) will have in the procurement. It discusses five important LCC/DTC issues which should be addressed and resolved well before source selection actually begins. Paragraphs 7-3 and 7-4 provide LCC/DTC related guidance with respect to planning and executing the evaluation of proposals.

7-2 Establishing the Role of LCC/DTC

If the source selection is going to have a significant role in picking the contractor who will best further LCC/DTC program objectives, the role of LCC/DTC must be clearly defined and well understood by both Government and contractor personnel. Several LCC/DTC issues are important in defining the role of LCC/DTC. They include: (a) use of LCC design trade studies, (b) defining the LCC management approach, (c) preparing life cycle cost estimates, (d) establishing design to cost targets and (e) using life cycle costing as an evaluation factor.

7-2.1 LCC Design Trade Studies

a. Proposal Instructions

The validation phase proposal instructions should call for the submission of proposed LCC trade studies to be accomplished during the validation phase. Acquisition and supportability cost reduction trades and maintenance concept studies are to be identified. Each study proposed should have a clear statement of the objective, a brief description of alternatives to be considered, relevant background information, level of effort and proposed methodology.

b. Evaluation Criteria

(1) Understanding the Task

(a) Cost. Does the proposal reflect thorough offeror understanding and importance of cost and does it reflect a proper balance of effort with technical performance and risk?

(b) Risk. Does the proposal indicate that the offeror has identified and understands the critical pacing items?

(c) Planning. Does the proposal indicate that the offeror has an adequate understanding of the intent of each study and does it reflect an appropriate level of effort?

(2) Soundness of Approach

(a) Cost. Does the proposal indicate that the offeror has an adequate understanding of the methodology to be used in the study?

(b) Risk. Does the proposal adequately reflect relevant background information?

(c) Planning. Does the proposal indicate an appropriate timing of the task and associated level of effort?

(3) Scope of Effort

(a) Cost. Does the proposal state how and to what degree the offeror intends to utilize related cost experience in support of his cost estimates?

(b) Risk. Does the proposal address the question of risk from the standpoint of time, cost, technology and performance and indicate that the offeror intends to optimize these factors?

(c) Planning. Does the proposal address a proper depth of treatment of the overall problem?

c. Statement of Work (SOW)

The validation phase SOW should include acquisition and supportability cost reduction trade studies to be conducted during the validation phase. Most of these may have been identified by the offerors in their proposals and selected and negotiated during source selection. This SOW should also require each contractor to identify during the validation phase, LCC trade studies for accomplishment during the full scale development phase.

7-2.2 LCC Management Approach

a. Proposal Instructions

The proposal instructions should call for the submission of the offeror's overall management approach to reduce LCC. This proposal should identify the degree of management involvement as well as the role of designers and engineers. It should address the plan for establishing life cycle cost goals and allocating these goals through a cost breakdown structure. The purpose will be to quantify specific LCC goals at a level where a meaningful association can be made with individual contractor engineers and individual Air Force engineers.

b. Evaluation Criteria

(1) Understanding the Task. Does the proposal reflect an understanding of the relationship between this and other areas of life cycle cost and does it reflect a proper balance with technical performance and risk?

(2) Soundness of Approach. Does the proposal reflect a proper balance between management attention and design/engineering involvement?

(3) Scope of Effort. Does the proposal state that the offeror will develop and provide a plan that will address varying degrees of emphasis consistent with the phase of development?

c. Statement of Work (SOW)

The validation phase SOW should call for the contractors to plan the overall full scale development approach to reduce LCC. This should include the identification of specific LCC objectives and a system of tracking the progress toward accomplishing the individual objectives. Each selected area should have its own "LCC assessment plan" in manner similar to a technical assessment plan. The plan should identify (1) what parameters are to be evaluated (such as time to repair, material cost to repair, skill/experience required, T.O., instructions, etc.); (2) when the assessments will be made (normally multiple assessments will be conducted as the item progresses through the development cycle); (3) how the assessments will be made (preliminary review of paper concepts by field maintenance personnel, breadboard or prototype demonstrations at the contractors' or vendors' plants or "hands on" assessment at an Air Force base or other facility); and (4) the success/failure criteria to be used during the assessment.

7-2.3 Life Cycle Cost Estimates

a. Proposal Instructions

The proposal instructions should call for the submission of

AD-A069 390 JOINT AFSC/AFLC COMMANDERS' WORKING GROUP ON LIFE CYC--ETC F/G 5/1
LIFE CYCLE COST PROCUREMENT GUIDE,(U)
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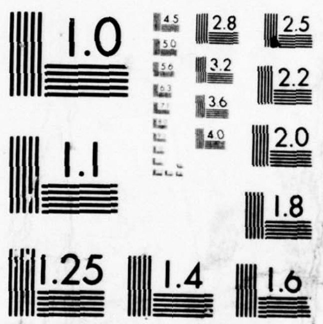

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the offeror's plan for providing cost estimates and cost estimating approaches and how the offeror plans to determine and identify high support cost items.

b. Evaluation Criteria

(1) Understanding the Task. Does the proposal reflect thorough offeror understanding of the cost estimating requirements and cost estimating techniques?

(2) Soundness of Approach. Does the proposal indicate that the offeror will discuss his use of operating and support cost estimates and support them with discussion, assumptions and rationale?

(3) Scope of Effort. Does the proposal state how and to what degree the offeror intends to utilize related historical cost experience in support of his cost estimates as well as explain and substantiate his application of related ground rules and assumptions?

c. Statement of Work (SOW)

The validation phase SOW should call for the submission of life cycle cost estimates at the end of the validation phase. In addition, the contractors should be required to address data sources, data validation and evaluation procedures and models used and proposed to be used during full scale development including recommendations to modify the Government supplied models provided for their review.

7-2.4 Design to Cost Targets

a. Proposal Instructions

The proposal instruction should call for the submission of the offeror's DTC management plan including the proposed breakout of DTC targets and the relationship to work packages. The proposal should also provide the basis for estimating these cost targets and proposed means of tracking.

b. Evaluation Criteria

(1) Understanding the Task. Does the proposal reflect thorough offeror understanding of the design to cost objectives and the intent and meaning of DOD Directive 5000.28, Design-to-Cost?

(2) Soundness of Approach. Does the proposal indicate how the offeror intends to determine DTC goals, allocate these goals in such a manner that they become design criteria, and plan for assessing progress toward achieving these goals? The approach should indicate the role of life cycle cost estimates and proposed design to cost goal adjustment provisions.

(3) Scope of Effort. Does the proposal state how and to what degree the offeror intends to utilize design to cost goals in his management and design/development efforts and the relationship to tradeoff studies?

c. Statement of Work (SOW)

The SOW should call for the establishment of design to cost (DTC) goals for each subsystem consistent with the work breakdown structure.

7-2.5 Life Cycle Costing as an Evaluation and Award Factor

This section contains a sample of source selection evaluation criteria in which life cycle costing is a primary factor in the award of the production contract. This sample is provided for information purposes only.

1.0 General

1.1 The award of the production contract will be based on a combination of the following criteria most advantageous to the Government. This criteria is listed in the descending order of precedence.

a. Life Cycle Costing (LCC)

b. Technical Excellence

(1) Results of reliability demonstration

(2) Degree of compliance with Minimum Acceptable Requirements (MARs), and risk associated with the corrective action necessary to meet MARs in production hardware.

(3) Environmental testing

(4) Compliance with stated goals.

c. Production Readiness Plan

d. Quality Control Plan

e. Production Testing Plan

1.2 An evaluation will be made of the life cycle costing proposals and a ranking of offerors will be established. Then, the technical excellence of each proposed equipment will be established by detailed examination of each area outlined in criteria b. above. These results will be compared against the ranking (evaluation criteria a. above) along with the offeror's response to criteria c, d and e above to

determine the combination most advantageous to the Government and award will be made on that basis. To assist the source selection team during the evaluation of production proposals, each offeror will submit with his proposal one of the test equipments used during the qualification program and an updated reliability prediction.

2.0 Specific

2.1 Life Cycle Costing (LCC)

The LCC proposal instructions of this RFP contain instructions and examples for the standardization of offerors' estimates of the life cycle costs of their proposed equipment. Included in the instructions is the requirement for preparing a cost breakdown structure and formats for submitting cost parameters and cost estimates. The technical rationale in support of the cost parameters must provide the depth of detail to allow for realistic evaluation of the offerors' LCC estimates by Government engineers and cost analysts. As a guide for source selection relative to LCC, the following parameters for each line replaceable unit (LRU) are considered most important:

a. Unit Price

b. Initial Acquisition Cost (Data, Support Equipment, etc.)

c. Failure Rate

d. Standards for removal/replacement and repair

These LCC estimates will be evaluated to the lowest level of detail to insure consistency, accuracy and reasonableness.

2.2 Technical Excellence

The results of the qualification program will be assessed and evaluated in the following order of precedence:

a. Results of the reliability demonstration testing will be reviewed in detail to determine actual performance of the equipment under stressed conditions.

b. For the various minimum acceptable requirements (MARs), the Government will take the following actions based on information obtained from qualification program test results and the offeror's proposal.

(1) Establish degree of noncompliance.

(2) Assess impact on equipment performance.

(3) Identify corrective action that requires the offeror's compliance with his production hardware.

(4) Perform a risk assessment and cost effective analysis of implementing or not implementing the corrective action.

c. Environmental test results will be reviewed in detail to insure corrective actions have been implemented and were successful in correcting any failures noted during these tests. Primary emphasis will be placed on the high risk tests such as temperature/altitude, vibration, and humidity.

(End of Sample)

7-3 Preparing for the Source Selection Evaluation

7-3.1 Determining Personnel Requirements

The type of system being procured, the complexity of the system and the time constraints placed on the source selection process are some of the important variables that will affect the number of personnel required. Since life cycle cost considerations may be a factor in the award, support cost visibility must be given equal treatment with acquisition costs. This normally requires the expertise of the using and supporting commands. Reliability and maintainability are key factors which influence support costs; therefore, independent assessments of these factors can prove invaluable in determing the reasonableness of the proposals. The important point is to determine the personnel requirements at an early enough time to get the people on board before the evaluation begins.

7-3.2 Developing Cost Estimates

A well documented cost estimate should be completed before the actual source selection begins. A life cycle cost model is normally developed or tailored for the particular program. This model should be readily available and, if required, programmed on a computer. The estimate should be refined utilizing each offeror's cost and technical parameters. The sensitivity of these parameters to the cost estimate should also be investigated. Every effort should be made to gather the necessary historical cost data, cost estimating relationships and current program cost data before the actual source selection evaluation begins. Additional information on developing a cost estimate is contained in the Life Cycle Cost Analysis Guide.*

* Life Cycle Cost Analysis Guide, November 1975, ASD/ACL.

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7-4 Evaluating Proposals

Each offeror's proposal should be reviewed for completeness and compliance with the RFP data requirements. Proposals should be evaluated in accordance with the established evaluation criteria. Establishing the evaluation criteria was discussed in Section 7-2, LCC/DTC Objectives, of this chapter. All alternatives and options that are proposed must be evaluated as well as offeror's best and final offers.

The results of these analyses should include an explanation of what areas and by what logic the proposal, alternatives, options and final offers differ. One task that is critical in developing a life cycle cost estimate and in assessing its validity is the task of determining that the specification submitted by the company does, in fact, offer at least as much as the proposal does. Proposals tend to claim optimisitic performance while the specification intended for inclusion in the contract is considerably less optimistic. These differences must be reconciled and the agreed to performance reflected in the life cycle cost estimates.

One of the most important evaluation tasks is to determine how the proposed designs differ with respect to life cycle cost. Design features likely to result in higher life cycle costs must be recognized and assessed. Likewise, the evaluation must also recognize and assess design features which will result in lower life cycle costs. Nothing will do more to get offerors to realize the Air Force is serious about life cycle costing than developing an in-house capability to correctly assess the life cycle cost differences between competing designs. Areas that must be clearly understood prior to evaluating the life cycle costs of the offerors include:

a. Acceptance of proposed maintenance concept based on the proposed design.

b. Acceptance of proposed support equipment list or proposed modifications to existing support equipment including any software changes that may be required (AGERDs/TRDs).

c. Acceptance of proposed data.

d. Assessment of submitted reliability and maintainability data.

e. Compatibility of life cycle cost proposals with the management, technical, logistics and cost proposals.

f. Assurance that all costs contained in the cost volume are accounted for in the life cycle cost estimates or rationale established for any differences between the proposal costs and the life cycle cost estimates.

Chapter 8

Contract Implementation

8-1 Introduction

The purpose of this chapter is to provide general information and guidance applicable to most programs on several important life cycle cost procurement contract implementation activities, including Government obligations, changes, life cycle cost verification testing, contract options and incentive fee plans.

8-2 Government Obligations

Success in implementing life cycle cost procurement depends to a great extent upon rigorous discipline in carrying out the Government's obligations. These obligations are significantly greater than those found in a contract for the same equipment that does not contain life cycle cost procurement provisions. The enforceability of life cycle cost contractual provisions are contingent upon the Government carrying out its obligations. Since life cycle cost provisions are new to many different disciplines, the Procuring Contracting Officer (PCO) should identify all the Government obligations, actions required, and responsible personnel. He should support the program manager by emphasizing the importance of these actions and assisting in implementing the management discipline required. This should be thoroughly outlined to all personnel by the PCO and all subsequent actions closely monitored. In many life cycle cost procurements, the Administrative Contracting Officer's (ACO) responsibilities are crucial for successful implementation. It is therefore critical that the ACO be thoroughly familiar with the background of the program, the life cycle cost objectives, the additional responsibilities necessary for successful implementation, and the potential impact of his obligations on the success of the LCC procurement aspects of the program.

8-3 Contract Changes

While review and implementation of change proposals is a way of life during many programs, the decisions made during this process can significantly affect the life cycle cost of the program. Contract changes may even require the Government to renegotiate life cycle cost procurement provisions in a sole source environment. Stringent change control procedures are essential. In addition, many life cycle cost procurements contain a provision whereby the contractor may submit no-cost (to the Government) ECPs in order to meet his contract commitments. In recognition of the contractor's motivation to reduce or control cost through hardware changes or improvements, the Government often provides for special and expeditious handling of contractor initiated "no cost" ECPs. The contract often requires the submittal

of a life cycle cost estimate based on a specified life cycle cost model. It is important that the contractor submit all required data in a single package for evaluation. This requires (1) the contract to be so structured, (2) the ACO be alerted to enforce these requirements, (3) and the validation of parameters that have changed from the baseline. Program office review of life cycle cost estimates requires special procedures and the evaluation of parameters which have changed from the baseline. The logistics support cost parameters will require a joint assessment by engineering and logistics personnel.

8-4 Life Cycle Cost Verification Testing

Many life cycle cost procurements require a post-award test plan to assess the contractor's success in achieving his life cycle cost commitment. Preparing the life cycle cost verification test plan requires considerable planning. Much of this planning should have been completed and reflected in the Request for Proposal (RFP). Implementing the verification test plan requires detailed operating procedures consistent with the following considerations:

a. The determination of the test sample size, method of sample selection (e.g., proportional to production rate), means of measuring usage (e.g., flying hours or operating hours) and source of measurement (e.g., AFM 65-110 reporting or elapsed time indicators).

b. The determination of how reliability maturation will be considered in test results if appropriate for selected equipment.

c. The determination of the appropriate length of the test and provisions for ensuring sufficient test hours.

d. The selection of representative test vehicles, and provisions for selection of a representative number of each type of test vehicle and expected usage.

e. The selection of representative test sites and operational scenarios.

f. The determination of who will accomplish the test (e.g., Air Force maintenance personnel), who will be selected and trained and whether or not they will be certified by the contractor. Close coordination with Air Training Command (ATC) prior to their award of their training contract is required to ensure adequacy of training.

g. The establishment of procedures for the maintenance, installation and removal of test samples.

h. The definition of test failures including exceptions for "acts of God."

i. The development of procedures for failure verification.

j. The determination of the requirement for review meetings to be attended by the contractor and specified Government representatives to review test procedures and test results.

k. The determination of the forms and procedures for data collection and reporting.

l. The determination of what constitutes the start and the completion of the verification test.

m. The determination of the formulae for the calculation of the measured cost.

Other critical actions include the selection and training of test cadre personnel, the selection and delivery of training equipment, the development and delivery of training material, the selection or development and delivery of support equipment for the test program, the establishment of base and depot repair facilities and the finalization of reporting procedures. All these activities require the involvement of the PCO. He plays a very critical role in ensuring that the Government obligations are fulfilled and that all procedures and implementing actions are consistent with the requirements of the contract. He also assumes the key role in meetings and negotiations regarding test results and contractor obligations.

8-5 Contract Options

Life cycle cost procurements may contain more than one of the life cycle cost procurement techniques described in Chapter 4 with the option to later select the technique most appropriate to the particular subsystem or First Line Unit (FLU). As an example, a contract may contain the option to select a Reliability Improvement Warranty, a Reliability Improvement Warranty with an MTBF Guarantee or Support Cost Guarantee for each or all equipments specified in the contract. Implementation of the life cycle cost procurement technique may also contain option provisions. For example, a Support Cost Guarantee (SCG) provision may contain a hardware correction of deficiency provision, a downward price adjustment provision, and a no cost additional spares provision. The selection of the option or combination thereof is often subject to negotiations with the provision that one of the options as specified in the contract will be invoked if a negotiated agreement cannot be reached. The primary decision criterion for selection of contractual alternatives should be the relative total cost to the Government, including lifetime logistics support costs.

The timing of the decisions and the comparative nature of the analysis may make design, development, and fabrication to be sunk costs, i.e., a cost incurred as a result of a prior decision that has no bearing on the current decision. A useful tool for analyzing logistics

support costs is the AFLC Logistics Support Cost (LSC) model. For most purposes, the LSC model can be simplified to include only the most significant costs. Usually spares, support equipment and maintenance costs are significant. Most support costs are dependent upon the reliability and maintainability characteristics of the equipment being procured. However, it is important not to equate reliability and maintainability driven support costs with resource requirements and their attendant costs. Noncost decision criteria can have a significant bearing on the selection of a preferred alternative if the cost of ownership is comparable or if the decision-maker concludes that a subjective issue is sufficiently important to override expected cost differences.

Life cycle cost contract options are relatively new procurement techniques. Consequently, little experience is available which clearly reveals the relative advantages and disadvantages of each approach. Therefore, nonquantifiable decision criteria must be based more on subjective judgement than historical facts. Subjective issues that should be considered include contractor motivation, legal enforceability, funding constraints, self-sufficiency, contractor risks, and the Government's ability to fulfill its contract obligations.

8-6 Award Fee Plan

An LCC award fee plan provides guidelines and procedures for evaluating contractor's accomplishments in minimizing logistics support costs pursuant to the provisions of the contract. The plan should designate the Fee Determining Official and Board members, the method of fee determination, the evaluation criteria and the evaluation process. The plan should identify the prime sources of information and provisions for the contractor to be given an opportunity to present his assessment of accomplishments attained during the evaluation period. Items that the contractor in his presentation should address include the following:

a. The relative magnitude of hardware support cost elements, the design factors that drive them, the alternatives that were considered and the actions and design decisions that have been made to control or reduce operating and support costs.

b. The approximate magnitude of the support cost savings for each element.

c. How the savings can be demonstrated during test and evaluation and initial operations.

d. The innovations in areas such as training, data and logistics planning that are proposed to reduce support costs.

The contractor's performance should be evaluated in accordance with the criteria contained in the applicable contract provisions as supplemented by the award fee plan. The major evaluation criteria should remain subjective, however, quantitative evaluation either in terms of a difference between target and measured support costs or trade study results can provide an indicator of contractor management involvement. The contractor's management of logistics support requirements, including training,reliability, maintainability and test and evaluation, should also be evaluated. The effectiveness and timeliness of meeting logistics support requirements at minimum cost of ownership should be factors considered in the evaluation. The ability of the contractor to provide operating and support cost visibility for use in the design process and the design and program decisions that resulted should also be a significant evaluation consideration.

Procedures should be established for periodic review and assessment of the contractor's progress and accomplishments. The contractor should be provided the results of this assessment.

Chapter 9

Lessons Learned

9-1 Introduction

Various life cycle cost procurement techniques have been incorporated into Air Force contracts. While it will be a matter of years before sufficient operational experience is available from which to make a final judgement on how beneficial the various life cycle costing approaches were, lessons learned are available from the program planning and initial contractual development and implementation efforts. Subsequent paragraphs will summarize the key lessons learned in the areas of developing a procurement approach, selecting the life cycle cost procurement technique and structuring the life cycle cost contractual provisions.

9-2 Procurement Planning

The single most important factor in determining eventual life cycle costs is the performance requirements demanded of the equipment. In the past performance requirements have often been established and finalized without the full understanding of their life cycle cost implications. Therefore, the importance of identifying minimum acceptable performance requirements as well as desired performance goals must be recognized. All procurement actions must encourage potential offerors to propose design options which would reduce life cycle costs while providing acceptable performance. It is important to clearly understand what the application of one or more life cycle cost procurement techniques is intended to accomplish. These objectives should be explained to potential offerors as early as possible in the conceptual or validation phase of the program.

Life cycle cost procurement techniques are not a substitute for, but rather an augmentation to, sound development, testing and acquisition planning and management.

Planning the use of life cycle cost procurement techniques and selection of options, such as, Support Cost Guarantee, Reliability Improvement Warranty or Reliability Improvement Warranty with MTBF Guarantee, requires planning for the budgeting for these options. This planning must recognize the conflict between the timing of the budget submission and the option decision date.

The development, testing and acquisition strategy should clearly permit the identification of the lowest life cycle cost hardware at the time of source selection. This is extremely important if the source selection will result in proceeding with only one contractor.

Adequate planning and preparation must be made for the Government validation of the many cost model data inputs submitted by the contractor. Data that cannot be evaluated should not be requested. Of primary importance during source selection is assuring that enough time and trained personnel are reserved for this task.

For the effective application of life cycle costing, there must be a continuing capability within the program office to evaluate and validate contractor life cycle cost data and assumptions.

One of the more significant benefits observed from past applications of life cycle cost procurement approaches was the ability to reduce spare parts and control follow-on spares prices by establishing priced options. In planning possible use of life cycle cost procurement techniques one should assure the Government has control of item unit prices. Control of spares prices might be achieved by including them as a line item in the contract or with contract provisions assuring that spares can be bought for a specified period at the same price as the same equipment when initially installed.

Another significant benefit observed has been the increased attention given to changes. The number of Government initiated change orders have been reduced significantly from similar past programs. In addition, the consideration of the life cycle cost impact of incorporating a change has provided the cost/benefit criteria which was often lacking from the evaluation of many changes on past programs.

Contractors are placing increased emphasis on testing and the consideration of operational environmental conditions. Life cycle cost procurement approaches require the identification of uncertainties and the control of risks. This reality may result in more realistic development and testing programs.

It is extremely important that when contract incentives are used, a balanced incentive program be carefully structured. Cost, schedule and performance objectives and minimum acceptable requirements must be considered. A balanced incentive program must be structured on realistic cost, schedule and performance requirements with incentives for delivery of better than minimum acceptable requirements. Above these minimum acceptable requirements, the program office and the contractors must be willing to trade performance and schedule objectives if costs can be reduced. The willingness to make such trades on past programs was lacking particularly when operating and support cost reductions were an issue.

Special planning is required when prime and subcontractors are involved in implementing life cycle cost procurement techniques. The prime contractor's level of support cost commitment for equipment to

be procured from subcontractors need not be specified initially in the prime contract, but may be specified later based on the support cost commitments the prime contractor can get from subcontractors. It is important to specify how much money the prime contractor can add to the price over the subcontractor's costs for systems integration and other support cost commitment associated costs. It is just as important to specify how much the prime contractor should be allowed to reduce the subcontractor's support cost commitments made to the prime contractor for the individual piece of equipment, in the subsequent specifications of the prime contractor's commitments to the Air Force.

9-3 Life Cycle Cost Procurement Techniques

9-3.1 General

Most LCC procurement techniques have some form of incentive. The timeliness of the evaluation and subsequent implementation of the incentive must be such that the amount of time between desired actions and award is minimum. New and innovative approaches are required in this area if incentives are to be truly effective at the working level.

The objectives and procedures for using a life cycle cost model must be clearly defined prior to their incorporation into procurement documentation. Early planning by the Government generally involving all prospective offerors is essential to assure that data requested from the offerors at source selection can be provided by the offerors and validated by Government personnel in a timely manner. These factors must be taken into consideration when selecting or tailoring a life cycle cost model for use in source selections or incorporation into contract provisions. Contractors must also be provided with many operational factors, such as, number of aircraft, utilization rates, number of bases, mission profiles, and maintenance concepts in order to provide the parameter values required for the model.

In a design to cost environment, some latitude should be provided to allow acquisition cost and operating and support cost tradeoffs. Provisions should be made for adjustment of acquisition cost targets when demonstrable operating and support cost reductions can be achieved.

If operating and support costs are to be validated by a test program, early information on the timing and details of that program should be provided to the contractors. This information will enable all contractors to base their logistics estimates on consistent information and in context with the test program. Many life cycle cost procurement techniques invite contractor gaming. It is important to recognize that gaming does exist and must be given serious consideration in structuring and implementing the contractual provisions and in evaluating offerors proposals. Gaming is discussed in Section 9-6. The importance of analyzing benefits and potential detrimental effects before structuring an incentive cannot be over emphasized.

9-3.2 Using Life Cycle Cost Estimates as a Source Selection Criteria

When comparison of life cycle cost estimates is a source selection criteria and plays a significant part in arriving at the source selection decision, the Government must have good arguments, based on sound analysis and specific design, quality or other differences, to substantiate its position that there is a high probability that the winning offeror will produce and deliver a lowest life cycle cost product. Extreme caution must be taken to avoid situations where, because one offeror is preferred over others for one or more sound, but unquantifiable reasons, a set of "soft" but quantified, life cycle cost estimates, favoring the preferred offeror is given as the primary basis for justifying the source selection decision.

9-3.3 Award Fees

The contractor should be given a basic understanding of the criteria to be used by the Fee Evaluation Board as early in the program as possible. This does not imply that a detailed weighting of such criteria is to be released to the contractor. However, the contractor should have some indication of whether or not, for example, a measured logistics support cost will have significant or a minimal influence on the award fee determination.

The baseline target logistics support cost against which the measured logistics support cost will be gauged should be established in a competitive environment and early enough to allow design activities to reduce the logistics support costs.

The life cycle cost validation or measurement period should be structured to allow for changes in the program schedule. The key point, is that the schedule should not be tied to dates and planned delivery schedules but rather to events and required test time. Care must be taken not to make the execution of the logistic support cost demonstration program dependent on Government actions over which the program office may have limited control.

If the award fee is based on design innovation to reduce life cycle costs, the Government must assess each proposed design innovation and decide whether or not it is innovative and how it should affect the award fee determination. This process may involve technically detailed reviews and assessments of what constitutes design innovation, usual design procedures and design features expected as the result of normal design evolution. Estimating the expected potential savings associated with design innovations, and their eventual worth to the Government is also a difficult task. Different weighting factors may be required in assessing expected savings for different areas of savings such as fuel, personnel and spares. Establishing objective rules for determining and awarding less than maximum award fee payments is a difficult task requiring considerable planning.

9-3.4 Support Cost Guarantee (SCG)

The cost effectiveness of a support cost guarantee type provision is sensitive to the contract type and sharing ratios of the incentives. The possible cost to the Government of corrective actions or changes must be understood at the time the support cost guarantee provisions are structured. A sharing arrangement in which the Government would pay most of the cost of corrective action until the contract's ceiling price is reached requires the Government to continually monitor and control the contractor's expenditures to meet the support cost guarantee. It is important to ensure that the contractor does not spend more money to reduce support costs than the Government will save in reduced support costs.

In the past contractors have chosen a competitive strategy of minimizing their proposal prices without regard to the possible advantages of combining a higher price with a lower guaranteed support cost. In close competition, offerors have often perceived having a lower acquisition price as being more important than offering a lower support cost design with lowered total life cycle costs.

9-3.5 Reliability Improvement Warranties (RIWs)

Generally equipments that can be designed for repair in the field with limited support equipment are not cost effective candidates for an RIW application.

Generally equipment contracts that have a short production schedule in relationship to the warranty period are not good candidates for an RIW application.

The projected return of failed equipment to the contractor must be large enough for the contractor to establish a capability to implement the objectives of the RIW.

Operational requirements must be well understood before the design is finalized and the equipment becomes operational.

Sufficient development and testing time must be allocated prior to the requirement for a firm-fixed priced bid.

Reliability observed in the laboratory is not the same experienced under field conditions. This must be recognized in assessing RIW applications since field reliability, costs to support the equipment and potential reliability growth must be reasonably predictable at the time the firm-fixed price is made. In this regard, firm-fixed price contracts make more sense after the first production items have operated under field conditions. Risks must be acceptable to both the contractor and the Government.

RIW provisions must be tailored to each individual application.

Evaluation of RIW costs can be a difficult task, and as such, this task requires management attention and sufficient planning.

Government obligations are substantial and involve many people.

One reason for using RIW is to get warranty commitments which might be useful to the Government, at a point in time when there is still competition to limit the price paid for such commitments. Possible changes in the program that are foreseen at that time should be addressed and provisions included describing how subsequent program changes would adjust the warranty commitments. Many program changes cannot be foreseen and will have to be handled by including provisions requiring that the warranty provision change implications of all proposed changes be approved by the Government prior to implementation. Both full scale development and production contract warranty commitment implications must be assessed in reviewing proposed full scale development program changes.

Warranties at the Line Replaceable Unit (LRU) level may not be cost effective if during the warranty period many expensive LRUs will be required which would not be required after transition to organic maintenance. In such circumstances, SRU warranties or LSC guarantee options may be more appropriate than an LRU RIW option.

Another problem and consideration that must be addressed is that returning only SRUs to the vendor's facility might not enable him to make design improvements which would improve equipment reliability in the manner generally intended by the application of RIW provisions. The nature of the device and what actions might possibly be taken to improve its reliability are important considerations in the feasibility of applying SRU level warranties.

RIW provisions generally require field tests to determine that a unit is bad prior to returning the unit to the vendor for repair under the warranty provisions. This is a Government responsibility. Unless these test procedures are specifically described or there is an agreement on when and how they will be evolved, problems can arise which might place the Government in a position of having to pay more for transportation and spares as the result of inadequate fault isolation or test equipment, such as poor BITE or avionics intermediate shop equipment performance, which are under the contractor controls.

9-3.6 Value Engineering Incentives

Value engineering procedures provide a sound means of reducing production and operating and support costs and should receive serious consideration in full scale development programs.

Caution must be exercised on contracts that contain design to cost or operating and support cost goals and incentives to prevent duplicative or redundant incentives.

9-4 Life Cycle Cost Contractual Provisions

The contract provisions should be structured to provide management awareness of life cycle cost implications. Past life cycle cost (LCC) provisions and techniques have been effective in obtaining top level management attention and displaying Air Force emphasis on LCC. However, there are reasons to believe that this emphasis has not been passed on to the work package managers, designers or the subcontractors. This may be attributed to the fact that many provisions display emphasis only and do not clearly convey objectives to which the contractor is expected to manage.

The contractual language must be explicit as to what changes can be made, how ECPs will be handled and processed, and how changes can impact the life cycle cost provisions.

Offerors' responses to life cycle cost provisions require considerable effort, often requiring a considerable amount of clarification resulting from misinterpretation or misunderstanding of the contract provisions. Although this may be true of any RFP provision, it appears to be more prevalent in life cycle cost procurement provisions.

The primary objective of LCC procurement provisions is to motivate the contractor work from the outset to design systems and equipment with low life cycle costs. Contract types which fully cover the contractor's costs if redesign of deficient equipment is required, may not provide adequate incentives to assure early and sufficient efforts are made to properly design and produce systems and equipments the first time. On cost plus contracts or fixed price incentive contracts, where the sharing ratio is such that the Government pays most of the cost of correcting high support cost design deficiencies, it could turn out that LCC provisions could require redesign and modification work, costing the Government more than the support costs that would be avoided as the result of such work.

A closely related issue is cost visibility. When decisions are being made to direct support cost reduction design changes, it is desirable to know what costs will be involved and to subsequently be able to assure that they are the only costs incurred by the Government as the result of LCC procurement provision induced design and production changes.

Some LCC procurement provisions motivate contractor to reduce support costs by redesigning the equipment based on field experience. No cost ECPs are often specified as the process by which such changes are to be made. However, the no cost limitation applies only to the engineering, modification and item update for the items covered, and

the Government may incur significant additional costs associated with support resources, such as support equipment, revised technical orders, and revised training requirements. For this reason, every no cost ECP proposal must be carefully assessed to determine its implications on support resources before it is approved. This may present a difficult situation when a contractor is pushing for timely approval of ECPs to meet his warranty or guarantee commitments and the proposed changes have significant and difficult to quantify support resource implications.

9-5 Implementing Life Cycle Cost Procurement Contract Options

While any single LCC procurement provision may adequately motivate contractors to do part of what is necessary to assure low life cycle costs, single provisions may not do all that is desired. To address this problem and obtain other benefits from being able to delay the final decisions on whether to use LCC procurement provisions or the selection of the most beneficial type of LCC procurement provision, LCC procurement options may be used.

The timing specified for making life cycle cost procurement option decisions is generally a compromise among several conflicting factors. On one hand it is desirable to make decisions early in order to properly plan and budget for the required funds for any warranty or guarantee provision desired. On the other hand, it is desirable to delay the decision as long as possible so the contractor will not tailor the design to a single maintenance posture which may best meet his objectives, but not be in the overall long term interest of the Air Force. In no case does it appear feasible to delay option decisions beyond the production decision, because, for example, a decision to use an RIW provision significantly affects requirements for spares, support equipment and technical orders which should be defined no later than the award of the production contract.

Option decisions should be based on life cycle cost analysis, with the selection of the lowest life cycle cost option. This type of analysis may be difficult because of the many factors and uncertainties involved. Of particular importance is the estimation of how the long term operational reliability of equipment may vary depending on which option the Government selects. Difficult but important forecasts must be made of what the eventual equipment MTBF would be with and without exercising RIW, RIW with MTBF guarantee or other options designed to motivate the contractor to improve the equipment MTBF. Unit equipment costs are of almost equal importance with the MTBF in computing logistics support costs. Therefore, since spares requirements may vary significantly with the option selected, it is important that care is taken to develop valid equipment cost and quantity estimates as a part of option decision analysis.

Although this point has been mentioned before, it cannot be over stressed. Some types of option provisions, such as logistics support cost guarantees, motivate a contractor to design so as to reduce base maintenance costs. Other provisions such as RIW motivate a contractor to design for timely contractor repair, which may involve high skill personnel and more complex test equipment, not conducive to base level repair. In structuring options and making option selection decisions, one must tailor the options and decisions to the specific program and its life cycle cost reduction objectives.

9-6 Gaming

Gaming occurs when an offeror applies a strategy designed to enhance his own self interest, in order to achieve some "unfair" advantage over competitors or at the expense of the Government's original objectives. The most important type of gaming associated with life cycle costing procurement incentives intended to motivate an offeror to design a product with lower operating and support (O&S) costs, may result in the offeror proposing unrealistically low O&S costs. The offeror will be most tempted to do this when:

a. Award is based on the sum of acquisition and O&S costs and he will not be held 100 percent accountable for O&S costs in excess of those promised.

b. The buyer is unable to assess the products offered and make comparable O&S cost estimates.

A second type of LCC procurement gaming occurs when an LCC model used to compute life cycle costs is not totally realistic. The offeror may propose a product and support plan designed to minimize life cycle costs as calculated by the LCC model by transferring costs to cost elements that were omitted or unrealistically low in the model to avoid being assessed with other costs which were properly reflected in the LCC model.

Care must be taken not to structure incentive provisions and use life cycle cost models that invite gaming. When offerors see that gaming is possible, there is a strong motivation for all offerors to enter into it, not to take advantage of the Government, but to remain competitive with the other offerors who have the same opportunity to game their bid.

Several actions can be taken to reduce the temptation for gaming or its detrimental affects when using life cycle cost procurement incentive provisions. The most effective by far is use of preaward testing where the relative O&S costs of all offerors' products are known at the time of source selection. Other actions to reduce gaming include:

a. Careful preparation and review of the O&S cost model and the equipment use and support assumptions to eliminate all opportunities for the offeror to assume support concepts which might result in a low estimated O&S cost, which would not be feasible or the lowest cost support concept for the Air Force. The most important action is to assure that no significant costs, associated with any allowed support concepts are omitted from the life cycle cost model associated with the incentive provisions.

b. Where practical, review life cycle cost models and procedures planned for subsequent use during a contract with all offerors prior to the RFP.

c. Have a good in-house prepared LCC cost estimate, prepared using the same model and assumptions to compare with each offeror's estimate during source selection to look for signs of gaming.

Appendix A

Support Cost Guarantee: Essential Elements of Procurement Documentation

Because Support Cost Guarantee (SCG) provisions must be tailored to the item or equipment selected, standard SCG clauses are not feasible. However, this appendix contains (1) a list of essential elements which should be considered, (2) guidance on where these elements may appropriately be incorporated into the standard Request for Proposal (RFP) format (AFSCP 70-4), and (3) a sample of procurement documentation if appropriate. These samples are provided for information and guidance only and to illustrate the degree of detail that may be necessary so that (1) potential offerors will have a clear and precise understanding of what is required, and (2) the procuring activity will have proper information for source selection evaluation and contract definitization.

Executive Summary

The executive summary should cover the overall role of life cycle costing in the procurement. If a support cost guarantee approach is being considered this should be stated.

Request for Proposal (RFP)

Volume I, Proposal Preparation Instructions

Volume I of the RFP covers two sections of the uniform contract format as prescribed by ASPR. These are Sections C and D. In Section C, "Instructions, Conditions, and Notices to Offerors," paragraph 42 covers preparation of proposals. These proposal requirements are usually packaged in six volumes to facilitate the offerors in preparing the proposals and the Government in its evaluation and definitization process. The following information will deal only with Volume 5, "Cost and Pricing," and Section D, "Evaluation Factors for Award."

Volume 5, Cost and Pricing

In general, the cost proposal and supporting data for the support cost guarantee will be contained in a separate part of the Cost and Pricing volume. Elements that may be covered in the instructions for preparing this part are discussed below.

1. The baseline quantity or quantities that are established for purposes of the cost proposal preparation (this may or may not include contract option quantities).

2. The economic price adjustment clause that is to be applied to the support cost guarantee option if applicable.

3. The Work Breakdown Structure (WBS) to be used in preparing the proposal. The support cost guarantee data is identified by Line Replaceable Unit (LRU) or First Line Unit (FLU). However, the Target Logistics Support Cost (TLSC) guaranteed is usually an aggregate of all LRUs or FLUs to be covered. It may also be advisable to identify critical FLUs and establish individual FLU targets.

4. Instructions for developing the TLSC component values and submitting the data with supporting rationale.

5. Government supplied data to be used in the TLSC computations.

6. Formats to be used for the cost proposals and instructions for completing them.

A sample of how these instructions may be stated is contained below.

Part _____ of the Cost Volume shall contain the Target Logistics Support Cost (TLSC) proposal with supporting data and rationale.

Support Cost Guarantee (SCG) Provisions

The logistics support cost control program is related to the _____ production options of the contract. The contractual provisions concerning the TLSC and the SCG are specified in the following paragraphs and parts of the RFP.

Award Fee/Price Adjustment

Support Cost Guarantee

Contractor Understanding of Support Cost Guarantee and Contractual Commitments Related Thereto

Verification Test Procedures Related to Contract Provisions on Support Cost Guarantee

Modified Logistics Support Cost (LSC) Model

Data Edit (to be included at time of contract award)

Contractor Data Sheets

Failure Definitions and Codes

All of these provisions should be carefully reviewed in preparing the TLSC and SCG proposal.

A copy of the FORTRAN program listing, together with a punched card deck, of the modified LSC model is provided with the RFP to provide offerors a more detailed description of the model and to aid in proposal preparation.

Structure of the SCG Provisions

At the time of contract award a TLSC will be established which will be the cost guaranteed by the contractor under the SCG. The TLSC will be computed using the modified LSC model with data inputs provided by the contractor as part of his proposal. After installation and deployment, a verification test will be conducted by the Government. (Further elaborate on the test length and conditions.)

Data gathered during this verification test will be input to the modified LSC model to arrive at a Measured Logistics Support Cost (MLSC). The MLSC will then be compared to the TLSC to measure the contractor's performance in achieving the TLSC, i.e., in fulfilling his SCG. If MLSC is less than the TLSC (the contractor will be eligible to receive an award fee/the positive price adjustment provision will apply). If the MLSC exceeds the TLSC, the contractor will be required by his SCG commitment to undertake corrective action or make a reimbursement to the Government.

Determining TLSC

As described in paragraph , the offeror shall submit a component breakout of TLSC by LRU/FLU. However, the TLSC guaranteed by the SCG is the aggregate total of all LRU/FLU component TLSCs. The final TLSC and final input data will be included in the contract.

SCG Proposals

The offeror's proposed cost for complying with the SCG shall be submitted in Part of the Cost and Pricing volume. The SCG cost broken out by LRU/FLU shall be submitted with Part of the Cost and Pricing volume (specific instructions in terms of formats or computer printouts should be specified).

The contractor shall provide a complete set of input data for the modified LSC model. (Specify the format.) The offeror shall also provide rationale for all data submitted. Where historical data is available to the offeror, the rationale should take into account actual performances of similar equipment. (If possible, historical data should be provided to each offeror, although it is to be made clear that this is not the only data that can be used if

other historical data is more appropriate.) The method by which the estimates were developed and sufficient information to evaluate the method shall be furnished with the estimates.

End of Sample

Section D, Evaluation Factors for Award

The evaluation criteria should state the relative importance of design to cost and life cycle cost in both the general and specific evaluation criteria. When an SCG option is included, it should be clearly stated how the Target Logistics Support Cost (TLSC) and SCG prices will be used.

Volume II, Model Contract

The model contract consists of the definition of the supplies and services to be procured, delivery requirements, all the terms and conditions, and contract administration data. It is a makeup of the information required by Sections E through L of the uniform contract format prescribed by ASPR. The following covers elements that may be covered in this volume. It is again important to emphasize that the elements and detail must be tailored to each program.

Section E, Supplies/Services and Prices

The Support Cost Guarantee (SCG) option and corresponding Contract Line Items (CLINS) should be identified with a description of how the SCG option will be exercised and applicable data CLIN.

Section F, Description/Specifications

The Support Cost Guarantee (SCG) provision and the appropriate Contract Data Requirements List (CDRL) for the SCG data should be covered.

Section H, Deliveries or Performance

The Support Cost Guarantee (SCG) provisions and applicable SCG data should be covered.

Section J, Special Provisions Support Cost Guarantee

Subsequent paragraphs discuss essential elements which should normally be included in a Support Cost Guarantee (SCG) provision and a sample of clauses for information and guidance only.

Part I - Statement of Contract Support Cost Guarantee

1. State the terms of the guarantee including compliance requirements.

2. State the coverage and provisions for exclusions.

3. State the verification test conditions.

4. State when and how the contractor must institute a corrective course of action.

5. State conditions for Government verification of deficiency corrections.

A sample of how these elements may be stated is contained below.

Part I, Statement of the Contractor Support Cost Guarantee (SCG)

1. Notwithstanding Government inspection and acceptance of supplies and services furnished under this contract or any provision of the contract concerning the conclusiveness thereof, the contractor guarantees that the Measured Logistics Support Cost (MLSC) will not exceed, in the aggregate, the Target Logistics Support Cost (TLSC) as computed using the modified Logistics Support Cost (LSC) model, ____________ for such LRUs/FLUs, when such measured values are obtained in accordance with the test program prescribed below. The components of TLSC, identified by LRU/FLU, are as stated in Section C, ____________; and the associated SCG target costs are as stated in Section E, ____________.

2. If for any reason the Government decides to exclude any or all LRUs/FLUs from coverage under the SCG, then the target cost, contract price including ceiling price will be adjusted by the applicable SCG amounts.

3. A verification test of ______ hours will begin no earlier than (six) months after the first squadron becomes operational/ equipped. (The test duration may be a function of the bid MTBF, and initial samples may be weighed to reflect MTBF maturation rather than delaying the start of the test. Conditions for test completion may also be a function of the bid MTBF; for example, total operating hours $\geq$ 25 x (bid MTBF) where each test sample operating hours $\geq$ bid MTBF.) *The Government will prepare a detailed test plan and data collection procedure for the verification test plan (__________) to assure that all of the data elements necessary*

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for quantification of MLSC are accurately recorded. The computation of MLSC will be made using the same cost equations used to compute the TLSC (__________).

4. In the event the MLSC exceeds the target (by more than _____ percent) the contractor must institute a corrective course of action which will bring the logistics support cost (on target/within the prescribed range). The contractor's proposed course of action must be submitted as a compatibility ECP to the Government, at no increase in contract price, for review and approval prior to implementation.

5. Following the correction of any deficiencies in accordance with the SCG, the Government may verify, through such additional testing as it may deem necessary, that the TLSC has been achieved.

6. The contractor commitment under the provision of this agreement will continue until satisfactory compliance has been demonstrated. Pending verification that satisfactory compliance has been demonstrated, the Government will withhold the last $__________ of payments otherwise due to the contractor.

7. If the contractor fails or refuses to (a) present a detailed recommendation for corrective action in accordance with paragraph _____, (b) correct deficiencies in accordance with paragraph _____, or (c) prepared and furnish data and reports in accordance with paragraph _____, the Contracting Officer shall give the contractor written notice specifying the failure or refusal and setting a period after receipt of the notice within which it must be cured. If the failure or refusal is not cured within the specified period, the Contracting Officer may, by contract or otherwise as required:

a. Obtain detailed recommendations for corrective action.

b. (1) Correct the supplies or services, or

(2) Replace the supplies or services -- and if the contractor fails to furnish timely disposition instructions, the Contracting Officer may dispose of nonconforming supplies for the contractor's account in a reasonable manner, in which case the Government is entitled to reimbursement from the contractor or from the proceeds for the reasonable expenses of care and disposition, as well as for excess costs incurred or to be incurred; and

c. Obtain applicable data and reports; and charge to the contractor the cost occasioned to the Government thereby.

8. ECPs submitted in accordance with paragraph _____ shall not be subject to the provisions of the value engineering incentive clause _____.

End of Sample

Part II - Contractor Obligations

1. State the contractor's obligations during verification testing.

2. State the contractor's obligations for initiating corrective actions, if required.

3. State the contractor's obligations in implementing corrective actions, if required.

A sample of how these elements may be stated is contained below.

Part II, Contractor Obligations

1. The contractor may supply representatives during the verification test to verify the authenticity of the observed data.

2. In the even the MLSC exceeds the TLSC (by more than ____ percent), the contractor shall investigate and formulate a corrective action plan or compatibility ECP which, if implemented, will bring logistics support costs (on target/within the prescribed range). The plan or ECP shall contain sufficient data to justify the efficacy of proposed actions.

3. No later than forty-five (45) days after notification that the MLSC exceeds the TLSC (by more than ____ percent) the contractor shall submit his proposed corrective action plan/compatibility ECP to the Government for review and authorization for implementation. The contractor shall after notification of such approval, implement the plan/proposal as specified.

4. The contractor shall incorporate all such deficiency corrections in all supplies deliverable in accordance with Section E of this contract, by either retrofit in accordance with contractor installed Time Compliance Technical Order (TCTO) of delivered items or incorporation during production at no increase in contract price. The items to which this requirement applies includes, but is not limited to, the entire production population of FLUs/LRUs, modules, SRUs, support equipment (SE), spares, training equipment, and technical data.

5. If the Government determines that retest is necessary (refer to paragraph ____), the contractor may provide representatives at the retest.

6. In the event that the retest data show that the MLSC fails to meet the prescribed level, the Government may repeat Steps 2, 3, 4 and 5 above.

End of Sample

Part III - Government Obligations

1. State the considerations under which the TLSC may be subject to adjustment.

2. State the Government's obligations for verification testing.

3. State the Government's obligations to notify the contractor in case of deficiencies.

A sample of how these elements may be stated is contained below.

Part III, Government Obligations

1. The TLSC will not be subject to adjustment prior to test measurement with the following exceptions:

a. Individual renegotiated values used in establishing the TLSC resulting from an approved Engineering Change Proposal submitted in response to a Government initiated request or a Government directed change.

b. Changes in the anticipated force structure or activity levels to be supported.

c. Adjustments to acquisition cost elements, as provided by the Economic Price Adjustment Clause.

d. Changes to factors defining the maintenance concept resulting from a Government approved repair level analysis conducted during Development Test and Evaluation.

2. The values for MTBFs used in establishing the TLSC will not be renegotiated except for Government initiated and directed changes. Further, any changes to organizational, intermediate, or depot level manhour values shall retain the same gross weighted cost values (manhours expended times labor rate).

3. The Government will prepare a detailed test implementation plan to implement the verification test plan. The Government agrees to provide a copy of this implementation plan to the contractor prior to verification testing.

4. The Government will perform the verification test.

5. The Government will notify the contractor of its intent to commence the verification test at least 30 days prior to the commencement of such test.

6. *The Government will compute MLSC based on values measured during the verification test.*

7. *The Government will notify the contractor within 30 days of the existence of deficiencies should the total MLSC fail to meet the (TLSC or prescribed range), but it shall remain the contractor's obligation to identify the cause of such deficiencies in accordance with the Support Cost Guarantee.*

8. *The Government will determine the nature and extent of any retest it deems is required to validate the efficacy of deficiency corrections.*

9. *In the event that the Government elects to retest, the price for any portion of the retest which is directed by the Government to be performed in the contractor's facility will be negotiated with the contractor as a change within the scope of the "Changes" clause of this contract.*

10. *The Government may elect to continue the retest until compliance with the (TLSC or prescribed range) is achieved. (If and when the MLSC equals or is less than the TLSC, the Government will determine the contractor's eligibility for the award fee or any part thereto in accordance with paragraph ____.)*

End of Sample

Contractor Understanding of Life Cycle Cost Provisions and Contractual Commitments Related Thereto Provision

This special provision is generally used on contracts that have various life cycle cost provisions. It is a corporate commitment certifying that high level corporate officials understand these provisions and are aware of their commitments.

A sample of this provision is provided below for information purposes only.

Contractor Understanding of Logistic Support Cost Guarantees and Contractual Commitments Related Thereto

The contractor acknowledges that this contract contains SCG provisions under which he has guaranteed that certain equipment furnished can be logistically supported by the Air Force within a certain dollar amount. In agreeing to these provisions the contractor represents that the following matters were considered:

1. The contractor fully understands the scope of the Support Cost Guarantee in terms of the corrective action obligation set forth elsewhere in this contract.

2. The contractor has prepared system specifications covering the items to be covered by the Support Cost Guarantee provisions. To the extent that Government specifications have been incorporated into contractor specifications for these items, the contractor has adopted such Government specifications as his own and accepts full responsibility therefor.

3. The contractor agrees that he will fulfill his logistics support cost commitment/guarantee within the terms of the existing contract and will not claim a change thereto because of inadequacies in any specification or difficulties arising from technical or economic problems that he may encounter. In other words, the contractor assumes all technical, economic, and other risks associated with fulfilling the Support Cost Guarantee, except as specifically provided otherwise in this contract.

4. The contractor agrees that the formulas, definitions of terms, data collection, and verification test procedures set forth under the SCG provisions of the contract are adequate for purposes of measuring and assuring proper enforcement of the Target Logistic Support Cost (TLSC) guarantees.

5. The contractor's obligation under the SCG provisions is not limited by dollars included in his price for such SCG coverage.

6. The contractor acknowledges that in submitting his proposal for the logistic support costs he has estimated the ratio between flying hours and operating hours. When the actual verification test is run, it is understood that measured logistics support costs will be based on the actual ratio between flying hours and operating hours, what it may turn out to be, in accordance with the formulas in the contract. If the actual ratio between flying hours and operating hours differs from the estimate/projection made by the contractor in his proposal, this will not be grounds for making any adjustment in the TLSC nor shall such deviation in any way affect the contractor's rights and obligations under the SCG, award fee, or other provisions of this contract. For purposes of these computations the Government will have no obligation to ascertain the actual recorded operating time on each individual Line Replaceable Unit, module or Shop Replaceable Unit.

7. The contractor understands the purpose and intent of the various definitions of a failure and agrees that all such definitions are reasonable in scope of coverage.

End of Sample

Verification Test Procedures Related to Contract Provisions on Support Cost Guarantee

A sample verification test procedure is provided for information purposes only.

1. *General*

a. This attachment describes procedures which are appropriate all or in part (exceptions noted) to the following provisions:

Paragraph _____, Section J, Award Fee
Paragraph _____, Section J, Support Cost Guarantee (SCG)
Paragraph _____, Section J, Contractor Understanding of Logistics Support Cost Guarantees and Contractual Commitments Related Thereto

b. The Modified Logistics Support Cost (LSC) model described in Appendix _____ to this attachment is the basis for determining the appropriate Target Logistics Support Cost (TLSC) cited in the provisions for the Logistics Support Cost Guarantee. This model was exercised using data furnished by the contractor and agreed to during source selection. The final data listing and values submitted by the contractor are contained in Appendix _____.

c. The associated data sheets submitted by the contractor in establishing the TLSC are indicated in Appendix _____.

2. *Determination of Support Cost Deficiency Correction Requirements*

a. For purposes of determining the extent to which the TLSC predictions and commitments have been realized, the Air Force will conduct a verification test program to demonstrate logistics supportability. The verification test will be initiated (identify base location(s) and time, such as no earlier than six months, or no later than twelve months, after delivering/equipping of an operational squadron). The Air Force shall be responsible for (in many cases the Air Force is responsible for organizational and intermediate level maintenance and supply support). The contractor is responsible for (in many cases, the contractor is responsible for depot level maintenance). Maintenance procedures shall conform with those prescribed in Air Force approved technical manuals. The test program shall continue until (_____ aircraft flying hours or equipment operating hours) have been accumulated. All maintenance actions shall be recorded during this time.

b. The data collected shall be used in the modified LSC model (Appendix _____) to establish the Measured Logistics Support Cost (MLSC). The variation indicated by the Government and undertaken by the contractor based upon the degree of achievement of support-

ability as demonstrated by the test. If MLSC exceeds _____ percent of TLSC, the contractor is required to initiate actions to correct the demonstrated support deficiency in accordance with paragraph _____, Section J.

3. Verification Test Procedures

a. The verification test program will be conducted to verify selected reliability and maintainability characteristics of the equipment and the associated support system. Not all factors originally estimated by the contractor can be verified by a base level operational test. Only those factors described in paragraph c, below, are subject to verification. In estimating the MLSC, factors not subject to verification measurement will remain the same as in the original TLSC. Generally, those elements in the model subject to actual measurement during the test program will normally be only those reflecting the achieved characteristics of the contractor's particular design. The failure of the contractor to deliver or prescribe qualified resources, such as support equipment, software, or adequate technical orders, will be reflected in the "work around" tasks necessary to maintain individual components.

b. The parameter values used in establishing TLSC will not be renegotiated except for Government directed ECPs. Further, any changes to organizational, intermediate, or depot level manhour values shall retain the same gross weighted manhour cost value (manhours expended times labor rate). In the event that a particular item experiences no failures during the verification test, the MTBF value and the ratio of operating hours to flying hours used for the item in computing MLSC shall be the same values used for that item in computing TLSC.

c. The following factors will be subject to verification or measurement during the test program:

FACTOR	MEASUREMENT METHOD
N, QPA, NRSU	Direct observation.
UC	The average negotiated unit prices in effect at the time of the beginning of the test. Refer to paragraph h.(1)(g) and h.(1)(h), below.
MTBF	The total reporting flying time during the test period times the Quantity Per Application divided by the number of failures for each item. For failure definition, see paragraph d(4) below. (It is to be noted that the MTBF established in this manner is expressed

in flying hours. As such, the value of 1/MTBF defined in this manner will be analogous to the expression (UF/MTBF) originally predicted while UF is defined as the ratio of operating hours to flying hours. No UF factor will be established directly. Measurement can be based on equipment operating hours using elapsed time indicators (ETIs).)

RIP, RTS, NRTS, COND	*Observed fraction of total failures repaired in place, in base-level shops, returned for depot repair, or condemned at base, respectively, as averaged over the test period.*
All Maintenance Manhour Values	*Reported manhour expenditures against appropriate Action Taken codes (see AFM 300-4). The recorded values will be averaged over the test period.*
SMI	*The schedule maintenance interval prescribed by the appropriate technical order.*

d. The following conditions, responsibilities, and obligations apply to measuring or verifying factors for determining TLSC and MLSC except as noted:

(1) LRUs, modules, and SRUs subject to evaluation will be those installed in the verification test aircraft and support equipment, as well as replacement spares delivered to support supply and maintenance requirements. Those components installed or delivered as replaceable spares will undergo normal acceptance test procedures. No extraordinary qualification testing or selection screening procedures will be authorized.

(2) All organizational and intermediate maintenance shall be performed by Air Force using-command personnel. Depot maintenance will be performed by the designated Air Logistics Center/Technology Repair Center to the maximum extent practicable. Contractor depot level maintenance services on selected items will not be a reason to defer conduct of the verification test unless such services include maintenance normally performed at base-level on items subject to the test. The contractor may provide representatives to be present during base level maintenance. In no event shall the absence of a contractor representative require the Government to delay any maintenance actions.

(3) The period of testing shall cover ______ (reported aircraft flying hours for aircraft assigned to the verification test squadron. The reported flying hours will be the governing factor in determining completion of the test program, rather than the elapsed

time accumulated on the equipment. An alternative method is to use equipment operating hours readings using elapsed time indicators.)

(4) *The definition of a failure will be consistent with that used for reporting consolidation under the AFM 66-1 Maintenance Data Collection System. A test failure shall be defined by the following combinations of How Malfunction codes and Action Taken codes: (valid How Malfunction codes for purposes of test failure definition from Volume XI, AFM 300-4 are indicated in Appendix _____ to Attachment _____. All codes not listed under Type 2 or 6 are defined as Type 1). Complete definitions of Action Taken codes will be as defined in AFM 300-4, Volume XI.*

(a) Any Type 1 How Malfunction code in combination with an Action Take code F (Repair), K (Calibrated-Adjustment Required), L (Adjust), or Z (Corrosion Repair).

(b) Any Type 1 How Malfunction code in combination with an Action Taken code P (Removal), R (Remove and Replace), or S (Remove and Reinstall), provided the item was not found serviceable (B Action Taken code) at the bench-check station.

(c) Any Type 1 How Malfunction code where the removal of the item was required because of the failure of associated components attached or connected thereto. Action Taken code G (Repairs and/or Replacement of Minor Parts, Hardware and Softgoods) will normally apply.

(d) Any Type 1 How Malfunction code for which the item is subsequently found to be serviceable at bench-check or depot verification and the erroneous failure identification is due to inadequately described test procedures or test equipment including built-in test (BIT) developed, procured, or prescribed by the contractor.

(e) A Type 2 How Malfunction code of 443, (does not meet specifications, drawings, or other conformance requirements) or 602 (failed or damaged due to malfunction of associated equipment or item).

(5) Failure identification and verification by the Government will consist of following the approved procedures specified in the appropriate Technical Order (T.O.). If an identification of a failure is due to the lack of an inherent capability in an associated piece of test equipment specified by the T.O., the failure will be considered as relevant, irrespective of the true condition of the failed item.

(6) Failure caused by reasons of fire, explosion, or aircraft crash, for which the contractor or his employees had no responsibility, shall not be classified as failures. If any questions arise concerning contractor responsibility, the contractor shall have the burden of establishing by clear and convincing evidence that he is not responsible for the damage.

End of Sample

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Appendix B

Reliability Improvement Warranty: Essential Elements of Procurement Documentation

Because Reliability Improvement Warranty (RIW) provisions must be tailored to the item or equipment selected, standard RIW clauses are not feasible. However, this appendix contains (1) a list of essential elements which should be considered, (2) guidance on where these elements may appropriately be incorporated into the standard Request for Proposal (RFP) format (AFSCP 70-4), and (3) a sample of procurement documentation where appropriate. These samples are provided for information and guidance only and to illustrate the degree of detail that may be necessary so that (1) potential offerors will have a clear and precise understanding of what is required, and (2) the procuring activity will have proper information for source selection evaluation and contract definitization.

Executive Summary

The executive summary should cover the overall role of life cycle costing in the procurement. If an RIW approach is being considered, this should be stated.

Request for Proposal (RFP)

Volume I, Proposal Preparation Instructions

Volume I of the RFP covers two sections of the uniform contract format as prescribed by ASPR. These are Sections C and D. In Section C, "Instructions, Conditions, and Notices to Offerors," paragraph 42 covers preparation of proposals. These proposal requirements are usually packaged in six volumes to facilitate the offerors in preparing the proposals and the Government in its evaluation and definitization process. These volumes are: Volume 1, General Summary; Volume 2, Technical; Volume 3, Management; Volume 4, Logistics, Volume 5, Cost and Pricing; and Volume 6, Contract Information. Subsequent information will deal only with Volumes 3, 4 and 5 and Section D, Evaluation Factors for Award.

Volume 3, Management

The detail and categories of information requested must be tailored to each proposal. The following example is for illustration purposes only.

Reliability Improvement Warranty (RIW)

1. The offeror shall submit a description of his approach for implementing the Reliability Improvement Warranty (RIW) clause in sufficient detail to indicate his understanding and willingness to implement this clause. The following aspects must be addressed:

a. In-plant material flow under warranty.

b. Failure verification at both intermediate and contractor repair facilities.

c. Repair verification test procedures at both intermediate and contractor repair facilities.

d. Turnaround time.

e. Receiving, storing and shipping.

f. ECP development and implementation.

g. Engineering feedback.

h. Warranty exclusions.

i. DCAS/AFPRO interface.

j. Data collection and analysis.

2. The offeror shall also provide information on his proposed warranty management, facilities and staffing, as well as a summary of his warranty experience.

End of Sample

Volume 4, Logistics

The following example is, again, for illustration purposes only.

Reliability Improvement Warranty (RIW)

The offeror shall provide his recommended support concept and potential spares and support equipment impact of implementing the Reliability Improvement Warranty (RIW) clause.

End of Sample

Volume 5, Cost and Pricing

In general, the cost proposal and supporting data for the Reliability Improvement Warranty (RIW) will be contained in a separate part of the Cost and Pricing volume. Elements that may be covered in the instructions for preparing this part are discussed below.

1. A statement that the RIW shall be proposed as a separate effort on a firm-fixed price (FFP) basis.

2. The baseline quantity or quantities that are established for purposes of the cost proposal preparation (this may or may not include contract option quantities).

3. The Economic Price Adjustment clause that is to be applied to the RIW.

4. The Work Breakdown Structure (WBS) to be used in preparing the proposal. Usually, each LRU or FLU will be priced separately. Although WBS items may include failure analysis, ECP preparation, ECP implementating, failure correction, warranty repair facility and secure storage area, consignment spares, packaging and data and record maintenance, these items normally will not be priced at this level.

5. Instructions concerning data pricing for RIW data items.

6. Cost formats and instructions for completing them.

Section D, Evaluation Factors for Award

The evaluation criteria should state the relative importance of design to cost and life cycle cost in both the general and specific evaluation criteria. When an RIW option is included, it should be clearly stated how the RIW costs will be used, since some of the RIW cost can be used as a surrogate of selected support costs.

Volume II, Model Contract

The model contract consists of the definition of the supplies and services to be procured, delivery requirements, all the terms and conditions, and contract administration data. It is a make-up of the information required by Sections E through L of the uniform contract format prescribed by ASPR. The following covers elements that may be covered in this volume. It is, again, important to emphasize that the elements and detail must be tailored to each program.

Section E, Supplies/Services and Prices

The Reliability Improvement Warranty (RIW) option and corresponding Contract Line Items (CLINs) should be identified with a description of how the RIW option will be exercised and applied to data CLIN.

Section F, Description/Specifications

The Reliability Improvement Warranty (RIW) provision and the appropriate Contract Data Requirements List (CDRL) for the RIW data should be covered.

Section G, Preservation, Packaging/Packing

Any peculiar packaging requirements applicable to Reliability Improvement Warranty (RIW) items should be covered.

Section H, Deliveries or Performance

The Reliability Improvement Warranty (RIW) provisions and applicable RIW data should be covered.

Section J, Special Provisions Reliability Improvement Warranty (RIW) Provisions

Subsequent paragraphs discuss essential elements which should normally be included in an RIW provision and a sample of clauses for information and guidance only.

Part I - Statement of Contractor Warranty

1. State the terms, including the length of the warranty.

2. State what constitutes a failure which will require the contractor to repair or replace a failed item, at his option, at no change in contract price, when it is returned to him.

3. State the exclusions, including what conditions (e.g., items lost or damaged due to fire, explosion, etc.) and actions associated with repairs (.e.g, packing, shipping, etc.).

4. State if the Government or contractor pays for shipping costs.

5. State any contract price adjustments applicable.

A sample of how these elements may be stated in the model contract is contained below.

Part I, Statement of Contractor Warranty

1. The contractor warrants that each __________ furnished under this contract will be free from defects in design, material, and workmanship, and will operate in its intended environment, in accordance with contractual specifications governing CLIN ______ through ______ of this contract for the warranty period set forth herein.

2. Any set/unit furnished under this contract that fails to meet the aforesaid warranty and is returned to the contractor by the Government shall be corrected or replaced, at the contractor's sole option and expense, so as to operate in accordance with the above contractual specifications. Each set/unit returned to the contractor by the Government shall be subjected to the tests of drawing number ______ following contractor corrective action. The contractor shall have the prerogative of performing additional tests if he desires. The Government shall have the right to witness the repair test procedure and review the documented results.

3. The contractor shall not be obligated to correct or replace at no cost to the Government any set/unit under these warranty provisions for nonconformance, loss or damage by reason of (1) non-(set/unit) induced fire; (2) non-(set/unit) induced explosion; (3) submersion, (4) acts of God, such as flood, hurricane, tornado, earthquake, lightning, etc.; (5) aircraft crash; (6) enemy action; (7) unit on which seal is broken outside contractor's control. In addition, the contractor shall not be obligated under these warranty provisions for:

a. Repair of external physical damage caused by accidental or willful mistreatment.

b. Repair of internal physical damage (not including electrical damage) which, in the determination of the Government, has been caused by accompanying external physical damage due to mistreatment or to tampering by non-contractor personnel.

The conditions specified above, except acts of God, apply only to loss and damages occurring on locations other than those owned and controlled by the contractor or occurring while the set/unit is not under the contractor's possession or custody.

There is a presumption that a set/unit returned to the contractor's repair facility during the warranty period is covered under this warranty and that only the exclusions listed above shall

void the contractor's responsibility to correct or replace at no increase in contract price under this warranty. The Administrative Contracting Officer (ACO) shall promptly determine whether any of the above exclusions apply to a returned set/unit upon receipt of the contractor's claim accompanied by clear and convincing evidence.

4. Notwithstanding the provisions of the "Inspection" clause (ASPR 7-108.5(a)) regarding the conclusiveness of acceptance and the waiver of defects which are susceptible to discovery prior to acceptance, the contractor shall be obligated to correct or replace any non-conforming set in accordance with the terms and conditions of this warranty. The rights and obligations of the parties under this warranty are in addition to and independent of the rights and obligations of the parties under the other provisions of this contract. Except as provided by the general provision of this contract entitied "Inspection," the contractor's obligations and the Government's remedies for correction and replacement of non-conforming sets are solely and exclusively as stated herein. In no event shall the contractor be liable for special consequential or incidental damages.

5. Sets/units returned for correction or replacement under this warranty for which the contractor cannot verify any nonconformance, shall be prepared for reshipment to the Government by the contractor. There shall be no adjustment in warranty price unless the number of such returns exceeds 30 percent* of the total number of returned sets/units in each reporting period. The total number of returned sets/units shall not include sets/units for which one or more of the exclusions listed in Part I, Paragraph 3, apply. The contracting officer will adjust the contract price and make payment to the contractor at the rate of _____ per set/unit for the number of such returns that exceed the foregoing amount in each reporting period. The first such period shall start six months prior to the initial anniversary date (as defined in Part I, paragraph 7) and subsequent periods shall be of six months' duration. The contractor shall promptly present evidence to the ACO or his designated representative that nonconformance of a returned set/unit cannot be verified. Documented results showing that the set/unit has successfully completed the test of drawing number _______ shall constitute evidence that a nonconformance cannot be verified.

6. The warranty period for production sets/units shall start upon Government acceptance or furnishing of units for IOT&E, whichever occurs first. It shall extend from date of delivery of the first set/unit of the specified production lot for a period of ______ months. A production lot is defined as ______________________.

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* This limitation may vary with equipment/application and should be negotiable.

7. For purposes of this warranty, the initial anniversary date shall be defined as ______ months after contract. This initial anniversary date is solely for the purposes of the reporting periods as used herein. ____________________ summarizes the periods appropriate for the various report submittals, contract price adjustments, and operate-time and MTBF measurements associated with these warranty provisions over the first _____ years following the initial anniversary date.

8. Any adjustments in contract price resulting from the provisions of this warranty will be made annually, no later than forty-five (45) days after acceptance by the Government of the Warranty Data Report referred to herein and other data and records required in Part ____ that are necessary for determining the contract price adjustment. The first such adjustment shall be made for the period from contract award to the initial anniversary date unless otherwise specified herein. Notwithstanding any other statements in this contract the "Economic Price Adjustment Clause," paragraph _____, Section J shall not apply to the following price adjustment factors.

a. The _____ per day liquidated damages for turnaround time delay.

b. The "K" factor for lost units.

c. The _____ per hour adjustment for operative hour differential.

d. The per set charge of ______ for excessive unverified failures.

End of Sample

Part II - Contractor Obligations

1. State contractor responsibilities for initiating and implementing Engineering Change Proposals (ECPs).

2. State contractor warranty marking requirements.

3. State contractor's requirements for maintaining a warranty repair facility and secure storage area.

4. State requirement for installation of seals.

5. State turnaround time required by the contract and contractual adjustments or other considerations that may be enacted if the contractor exceeds the number of days specified.

6. State the contractor's requirement to maintain records, and make such records available to the Government upon request.

7. State that the contractor is required to cover applicable warranty provisions in user activity technical manuals.

A sample of how these elements may be stated in the model contract is contained below.

Part II, Contractor Obligations

1. All contractor initiated ECPs for improvement of reliability or maintainability of the set/unit shall be covered per normal MIL-STD-480 procedures; however, they shall be incorporated during the warranty period at no change in contract price. Modifications resulting from ECPs incorporated in the contract must be implemented by the contractor into all new production sets/units and into all items returned to the contractor. The contractor may, with approval of the Government institute field changes to effect modifications. To assure that all sets/units specified in this contract are of the latest configuration after expiration of the warranty the contractor will be obligated to supply the necessary parts (modification kits, etc.) to the Government, at no cost to the Government for all sets/units known not to be of the latest configuration and still in the U. S. Air Force inventory.

2. The contractor shall cause a suitable and prominent display of the following warranty information in form and content satisfactory to the contracting officer to be placed conspicuously on the surface(s) of the units of the set in a way that insures visibility when units are removed from the aircraft:

THIS UNIT IS UNDER WARRANTY UNTIL: (Date of Warranty Termination)

DO NOT BREAK OR TAMPER WITH WARRANTY SEALS

IF THIS UNIT FAILS WITHIN THE WARRANTY PERIOD, THE FOLLOWING ACTION MUST BE TAKEN BY THE USING ACTIVITY:

(1) Verify the failure using approved procedures and test equipment.

(2) Record failure circumstances data and line tester findings on AFTO Form 350.

(3) Package the unit, including the completed AFTO Form 350, in an appropriate shipping container and promptly return unit to (contractor's address).

A form for permanently recording aircraft installation and removal dates by Government personnel shall also be affixed to each unit. This form shall also have a column next to the removal date for the contractor to record a code representing the result of contractor/ACO action if the unit was returned to the contractor. The suggested coding scheme is as follows:

Blank or Zero - Unit removed from aircraft but not returned to contractor for warranty service.

1 - Failure not covered under warranty (ACO concurrence).

2 - Failure verified, corrective action taken under warranty.

3 - Failure not verified (ACO concurrence).

Within sixty (60) days after receipt of award, the contractor shall submit to the PCO for approval the proposed wording, content and placement of this information. Material suitability and method(s) used to apply this data to the set/unit shall also be submitted at this time for Government approval.

3. The contractor shall maintain throughout the warranty period a fully operational warranty-repair facility located in the Continental United States. The contractor shall maintain at this repair facility a secure area for storage of Government-owned spare and repaired sets/units. Property control of any GFE sets/units will be in accordance with the ASPR Appendix B "Manual for Control of Government Property in Possession of Contractors."

4. The contractor shall provide and install appropriate seals for all units in the set/unit which shall minimize inadvertent seal breaking. Furthermore, the design of the seals should be such that a breaking of a seal through tampering will be evident.

5. a. In the event of a non-conformance of a set/unit, the Government shall promptly notify the contractor in writing or by electronic message (.e.g, TWX) of said non-conformance and shall provide the serial number for the non-conforming set/unit. Failure to provide the serial number of the non-conforming set/unit, however, shall not relieve the contractor from any of his responsibilities under this warranty.

b. Upon receipt of such notification, the contractor shall package and ship a replacement Government-owned set/unit from the secure storage area to the appropriate Government facility. To the extent possible, a first-in/first-out basis shall be used in selecting sets/units for shipments from the storage area. Such shipment shall be made within one working day from the time of receipt of notification. Preservation, packing and packaging shall be in accordance with Section G of the schedule of this contract. For shipment the contractor shall use a Government Bill of Lading (GBL) accompanied by a DD Form 1149 for transfer of Government property accountability. In the event that spares in the secure storage area are insufficient to meet demand, the contractor shall follow a shipping-priority system at the direction of the contracting officer.

6. Within an average of ____________ calendar days from receipt of a returned set/unit for which this warranty is in force, the contractor shall correct, replace or install approved modifications in such sets/units as necessary and store the sets/units in the secure storage area. This turnaround time requirement shall apply to all units returned except those to which one or more of the exclusions listed in Part I, Paragraph 3 apply. The contractor shall not be liable for any time delays if the failure to perform the contract arises out of casues beyond the control and without the fault or negligence of the contractor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the contractor.

7. Calculation of average turnaround shall be made over six-month periods. The first such period shall start six months prior to the initial anniversary date, and subsequent six-month periods

shall follow consecutively until warranty termination. If the average turnaround time in a six-month period is greater than fifteen (15) days,* as computed from warranty data records, the contractor will be assessed a liquidated damage** in accordance with the following formula:

$$\text{Liquidated Damage} = \underline{(\$25)}^{*} \times (\bar{T} - 15^{*}) \times R$$

where

R = number of returned items for which the turnaround time requirements applies that have been received by the contractor during the six-month period.

$\bar{T}$ = average turnaround time of the R returned items during the six-month period calculated to three decimal places from the equation T = D/R. D is defined as the total number of days for contractor processing of R items returned for warranty service, measured to the nearest hour for each returned item, from the time the return is received by the contractor to the time the item has passed the warranty repair test procedure.

This formula is based on a liquidated damage of ($25 per day)* for each unit which, on the average, exceeds the fifteen day requirement. Such a fixed amount is established and agreed to by the contractor in recognition of the fact that actual liquidated damages will be difficult if not impossible to determine. The above liquidated damages will be assessed in accordance with provisions of paragraph (f) of the Default clause.

8. The contractor shall maintain records by serial number for each unit under warranty as required in Part ____ hereunder. Upon request, these records and associated data and documentation shall be made available to the Government at the contractor's plant during the warranty period for review of their adequacy and accuracy.

9. The contractor shall place those warranty provisions applicable to using activities in all pertinent Technical Manuals under this contract.

10. The contractor shall have a continuing responsibility to accept for correction or ECP installation and to complete the correction or ECP installation of, or furnish a replacement for, any set/unit shipped to the contractor's repair facility with a shipping date on or before the last day of the warranty period notwithstanding any other provisions of this warranty.

End of Sample

* Must be determined on a case by case basis.

** A clause requiring consignment units may be used in lieu of a liquidated damages clause.

Part III - Government Obligations

1. State the Government's obligations to verify failures and provide to contractors failure circumstances data and test information.

2. State packing and shipping requirements.

3. State when planning data, such as number of installed units and flying hour program, will be provided the contractor.

4. State the Government's obligations for processing ECPs.

A sample of how these elements may be stated in the model contract is contained below.

Part III, Government Obligations

1. The Government shall

a. To the extent practicable, verify the non-conformance using appropriate procedures and test equipment.

b. Furnish to the contractor, to the extent possible, complete failure-circumstance data and test readings, correctly recorded on AFTO Form 350 or equivalent.

c. Utilize, to the extent practicable, packing and packaging per MIL-STD-794 for all shipments of the sets/units and include a proper transfer of custoday form (DD Form 1149).

d. Promptly ship each nonconforming set/unit to the contractor.

e. Notify the contractor of defects, deficiencies or nonconformance of a set/unit, and provide shipping instructions for delivery of a replacement set/unit. (See Part II, Paragraph 5.a.).

f. Furnish information to the contractor each six (6) months regarding number of aircraft installations during the period.

2. In recognition of the high contractor motivation for total cost control effected through these warranty provisions, the Government agrees that all no-cost ECPs submitted in accordance with MIL-STD-480 to improve reliability and maintainability for the sets/units will receive special, expeditious processing. Notwithstanding

this special processing, any such ECP shall be formally incorporated in the contract by the Government thirty-five (35) days after receipt by the PCO unless the contractor has received written notification of its non-approval from the Government prior to that date.

End of Sample

Part IV - Miscellaneous

1. State how the Government plans to cover correction, replacement or disposition of item, actions or events not covered by the warranty.

2. State procedure for adjustments in contract price for unused portions of a warranty.

3. State the disposition of material removed from any unit pursuant to the warranty.

4. State the planned program operating time and provision for contract price adjustment due to significant differences.

A sample of how these elements may be stated in the model contract is contained below.

Part IV, Miscellaneous

1. The Government shall negotiate a separate contract with the contractor to cover the correction, replacement, or disposition of sets/units that have sustained damage attributable by the ACO to the causes/events set forth in Part I, Paragraph 3, of this warranty.

2. An adjustment in contract price shall be made for the unused portion of the remaining warranty for any set/unit that has sustained damage attributable by the ACO to the causes/events set forth in Part I, Paragraph 3, and that is not corrected or replaced under the provisions of the separate contract referred to in this Part IV, Paragraph 1, or any set/unit that, upon certification of the contracting officer, is declared lost.

For each set/unit for which adjustment is applicable, the contract price will be decreased by an amount equal to K x RDW, where K is specified in the table below and RDW is the remaining number of days of warranty from the day the set/unit was declased lost or damaged beyond repair and not replaced.

3. When a set/unit is returned to the Government after being sent to the contractor for corrective action or replacement under the warranty provisions of this contract, the balance of the warranty period will be applicable to the returned set/unit.

4. All material removed from any set/unit or any unit replaced pursuant to this warranty shall become contractor's property except as provided herein.

5. The Government shall not be obligated to provide facilities, tooling, or equipments of any type for contractor performance under this warranty except as identified in the Government Furnished Property Clause of this contract.

6. The pricing of this RIW provision shall be based on an average operating time of _____ hours per month for _________ units delivered to the Government and installed in aircraft. Starting twelve (12) months after the initial anniversary date (as defined in Part I, Paragraph 7) and annually thereafter, the contract price shall be adjusted as necessary to account for significant deviations (greater than plus or minus 5%) from the _____ hour standard.

Such adjustments shall be made by analyzing the elapsed-time-indicator (ETI) readings of the units returned during the preceding twelve (12) months to estimate total operating time and comparing this estimate with operating time expected for a _____-hour-per-month average. No adjustment shall be made for an operating hour differential for the period from contract award to the initial anniversary date.

Definitions and Equations

N_j = number of aircraft that contained an installed set on the last day of the j^{th} month of the twelve month measurement period.

(These values are to be supplied by the Air Force)

$\overline{N}$ = average number of installed sets over the twelve month period.

$$= \frac{1}{12} \sum_{j=1}^{12} N_j$$

AOT = average operating time per day per unit.

$$AOT = \frac{\text{Total elapsed operating hours of all units returned during the twelve month measurement period}}{\text{Total installed days of all units returned during the twelve month measurement period}}$$

The elapsed operating hours of a unit returned during the measurement period is defined to be the ETI reading of the unit when received by the contractor minus the ETI reading of the unit when last shipped by the contractor. The number of installed days of a unit returned during the measurement period is defined as the total number of days the unit was installed in an aircraft starting with the date the unit was last shipped to a Government installation to the date the unit is received by the contractor. It is noted that the values in the numerator and denominator of the above equation must be based on the same units. If all required data are not available for a returned unit, then that returned unit shall be excluded from the calculation of AOT.

The following is a sample computation based on an expected operating time of 68 hours per month average, a fifty cent adjustment per hour for operating hour differential and a maximum downward warranty price adjustment of $200. All factors in this sample must be tailored to the individual program.

T_{68} = *unit operating time over the twelve month measurement period based on a 68 hour per month average value*

= $12 \times 68 \times \overline{N}$

T_{ETI} = *estimated unit operating time based on ETI readings of units returned during the measurement period and on installed days measurements*

= $AOT \times 365 \times \overline{N}$

The warranty price adjustment shall be calculated as follows:

If T_{ETI} is greater than or equal to $0.95 \times T_{68}$ and less than or equal to $1.05 \times T_{68}$, then there shall be no adjustment in warranty price for the twelve month period under consideration.

For T_{ETI} less than $0.95 \times T_{68}$, the downward warranty price adjustment shall be equal to $\$0.50 \times (0.95 \times T_{68} - T_{ETI})$. However, the downward warranty price adjustment for operate-hour variance shall not exceed $\$200 \times \overline{N}$ for any twelve month measurement period.

For T_{ETI} greater than $1.05 \times T_{68}$, the upward warranty price adjustment shall be equal to $\$0.50 \times (T_{ETI} - 1.05 \times T_{68})$.

End of Sample

Part V - Warranty Data Requirements

1. State that the contractor will be required to establish and maintain a data system capable of providing data and information on reliability and maintainability and the effectiveness of the warranty program.

2. State warranty data report requirements.

A sample of how these elements may be stated in the model contract is contained below. However, this part of the Reliability Improvement Warranty provision may be covered by appropriate Data Item Descriptions (DIDs). Two unique DIDs have been developed and are being used on a limited basis. Prior to structuring the Warranty Data Requirements provision these DIDs should be reviewed. The office of primary responsibility (OPR) for these DIDs is AFLC/MMMC. The DIDs of interest are:

UL-83-MM, Reporting Materiel Transactions-Contractor Storage/ Distribution Point

UL-84-MM, Reliability Improvement Warranty (RIW) Data Reporting and Summary Reports

Part V, Warranty Data Requirements

1. The contractor shall develop and maintain a data accumulation, processing, analysis, and reporting system capable of providing the data items necessary for implementing any of the provisions of this warranty, and capable of providing to the Government data and information on the reliability and maintainability of the set/unit and the effectiveness of the warranty procurement concept. All data required herein shall be made available to the Government at the contractor's plant upon request during the warranty period. The Government will provide, to the extent possible, applicable maintenance and utilization data to the extent generated by the Air Force 66-1 Data System.

2. The contractor shall establish and maintain records of each returned set/unit consisting of the following data items:

Data received by contractor
Serial number
ETI reading (if applicable)
Condition of unit based on initial inspection
Failure mode
Probable failure cause
Action taken for repair
Manhours expanded by labor category
Parts and material usage
Test results
Date stored in secure storage area

3. The contractor shall provide a semi-annual warranty data report covering warranty experience over each six-month reporting period. However, the first such report shall cover all warranty experience up to the initial anniversary date (as defined in Part I, Paragraph 7). Such reports will be delivered to the Government within 60 days from the end of the reporting period. This report shall, at a minimum, contain the following:

a. Set/Unit Initial Delivery: a record, by serial number, of each set/unit showing ETI, date of shipment, and shipping distination.

b. Corrective Action Summary: a record by serial number of corrective actions of sets/units showing originating field activity (if available) ETI reading, date of receipt, contractor corrective action, warranty coverage applicability, manhours expended by labor category, parts and material and date of repair completion.

c. Secure Storage Area Population: a listing of the number of each type of unit in the secure storage area at the end of each month in the reporting period.

d. Unit Cycle Time: to the extent practicable, a summary and analysis, by unit type, of the number of days for the major elements of the corrective cycle as follows:

Contractor receipt

to

Storage in secure storage area

to

Shipment to Government activity

to

Installation in aircraft

to

Removal from aircraft

to

Shipment to Contractor

to

Receipt by Contractor

e. Set/Unit Reliability: a summary and analysis of the operational field reliability, including mean time between failure measurements by unit type and, to the extent possible, mean time between removal information. Analysis of causes, modes, trends and patterns of field failure and actions taken, recommended or projected for corrective action shall also be included. To the extent possible, the effects of varying field environment (e.g., aircraft type) on operational reliability shall be investigated.

f. Modification Status Summary: a summary of modifications recommended and incorporated by the contractor for reliability/maintainability improvement and a record by serial number of the modification status of each delivered set/unit.

g. Warranty Population: a monthly summary by unit type of the number of units known to be in the Government inventory under warranty, listed according to the amount of remaining warranty period. Information concerning lost units or units declared non-reparable should also be summarized.

h. Contract Price Adjustment Statistics: a record of measurements and calculations necessary for implementing the provisions pertaining to contract price adjustments. To be included are the following:

(1) percentage of returns with unverified nonconformance

(2) average turnaround time

(3) operate time measurements

(4) number of lost units

(5) unit MTBFs

i. Other pertinent data, facts, information, and investigations that the contractor, at his discretion, believes will be of value to the Government in implementing and evaluating the RIW concept.

4. The contractor shall provide an annual Warranty Effectiveness Report. The first such report shall cover the period from contract award to twelve months after the initial anniversary date and shall be delivered to the Government within sixty (60) days from the end of that period. Subsequent reports shall be issued annually. The Warranty Effectiveness Report shall contain:

a. A report of experiences and conclusions regarding the effectiveness of the warranty concept applied to this contract.

b. Recommendations and suggestions regarding warranty-clause provisions that may be of mutual benefit to the Government and industry in future procurements.

5. A data collection, analysis, and reporting plan shall be submitted 120 days after the effective date of the contract, detailing the data records to be maintained and the report format to be provided for both the Warranty Data Report and the Warranty Effectiveness Report.

Reports shall be delivered to the PCO for final acceptance.

End of Sample

Economic Price Adjustment Provisions

Provisions applicable to the Reliability Improvement Warranty (RIW) provisions must be covered. The Labor and Material Indices to be used are normally based on the Bureau of Labor Statistics (BLS) of the U. S. Department of Labor. The index for computation of the change in labor and labor related costs may be the BLS material index of earnings data for the applicable Standard Industrial Classification (SIC) as published in the applicable table of Employment and Earnings. The index for computation of the change in material and material related costs may be the BLS national data for the applicable Wholesale Price Index (WPI) code as published in the applicable table of Wholesale Price and Prices Indexes. Application of these indices to the RIW provision may require the development of Planned Expenditure Profiles and the determination of the percentage of the applicable Labor and Material Costs that are subject to adjustment.

Technical Data

References should be made to the implication of technical data requirements under the RIW provision.

Configuration Control

Reference should be made to the processing of no-cost ECPs in accordance with the RIW provisions and the requirements on Government initiated ECPs in relationship to the RIW provisions.

Spare Provisioning

Reference should be made to the implication of spares provisioning under the RIW.

Part III, General Provisions

Section L, General Provision

The default provision of the contract clauses set forth

in ASPR should be identified as applicable to the Reliability Improvement Warranty provision.

Part IV, List of Documents

Section M

Include the RIW Data Exhibits in the Contract Data Requirements List (DD 1423).

Volume III, Attached Documents and References

Section M

1. Include an exhibit covering the Contract Data Requirements List (DD 1423) item for the RIW data.

2. Ensure that for ECPs submitted under RIW appropriate Data Item Descriptions are submitted concurrently with the ECP.

3. If special provisions on the processing time for ECPs submitted under the RIW is covered in the contract, a statement to this effect should be prominently displayed on all ECPs submitted in accordance with this provision.

4. Statement of Work and specifications should be prepared to reflect the possibility of implementing the Reliability Improvement Warranty provisions. Considerations that may be involved include the maintenance concept, training tasks, support and test equipment, testing and fabrication specifications that describe an acceptable versus defective item which may be critical to the failure definition under the Reliability Improvement Warranty provision.

5. Contract Work Breakdown Structure should be consistent with the instruction for preparing the cost volume of the proposal and reflect the requirements of implementing the Reliability Improvement Warranty provision.

Appendix C

Reliability Improvement Warranty with MTBF Guarantee: Essential Elements of Procurement Documentation

The elements of procurement documentation discussed in Appendix B for Reliablity Improvement Warranty (RIW) are applicable to the RIW with MTBF Guarantee. However, it is important to separately identify the MTBF guarantee option whenever the RIW is discussed. Just as the RIW provision must be tailored to the item or equipment the same is true of the MTBF guarantee provisions. This appendix provides a sample clause that may be added as a rider to the RIW provision. This sample is provided for information and guidance only and to illustrate the degree of detail that may be required.

Section J, Special Provisions, Reliability Improvement Warranty

Part V, MTBF Guarantee

1. The contractor shall guarantee that each type of nomenclatured unit will achieve a mean time between failures (MTBF) value such that the set MTBF is equal to or greater than that shown below:

Anniversary Date:	____ *Set MTBF*
Period 1:	____ *hours*
Period 2:	____ *hours*
Period 3:	____ *hours*

2. For this guarantee, unit (Set) MTBF is defined to be the total operating hours of all units (Sets) in the active Government inventory that were accumulated during a specified period, divided by the total number of relevant verified failures of all such units (Sets) during the specified period. A unit that requires correction or replacement by the contractor under the warranty provisions shall be counted as one relevant verified unit failure, e.g., no more than one relevant verified unit failure per set/unit per return. Returned units which are classified as unverified failures as corroborated by the ACO and for which adjustments or preventive maintenance actions are made, or approved ECPs are incorporated shall not be counted as a failure for purposes of MTBF calculation.

3. The contractor shall perform a reliability apportionment in accordance with MIL-STD-756 and MIL-STD-785 unless otherwise

specified herein in order to allocate the set MTBF values specified in Part V, Paragraph 1 above to the unit level. These allocated MTBF values shall be the guaranteed unit MTBFs and are subject to review by the Government. Such apportionment shall be based on the assumption of a serial design such that the reciprocal of the set MTBF is equal to the sum of the reciprocals of the unit MTBFs.

4. For each type of unit, the contractor shall make semiannual measurements* of the unit MTBF achieved over the previous six (6) month period. These measurements will be based on the performance of all units in the active Government inventory. The first such measurement shall be made six (6) months before the end of Period 1 as defined in Part V, Paragraph 1, above. Paragraph 11 provides the basis upon which such measurements shall be made. The contractor's obligation with respect to a particular unit MTBF guarantee shall terminate when two (2) consecutive measurements yield unit MTBF values that equal or exceed the guaranteed unit MTBF values for the _____ through _____ month period, but in no event shall the contractor's obligation terminate earlier than _____ months after contract award nor be continued beyond _____ months after contract award from that date unless annually agreed to otherwise. Appendix A, which is made a part of this contract, summarizes the MTBF measurement periods applicable for the MTBF guarantee. Notwithstanding the termination of the MTBF guarantee, the RIW shall continue in accordance with the applicable provisions of that clause.

5. In the event that a measured unit MTBF for any measurement period is less than the guaranteed unit MTBF value corresponding to that period, the contractor shall furnish the Government, at no additional cost to the Government, the following:

a. Engineering analysis to determine cause of nonconforming MTBF

b. Corrective engineering design changes

c. Modification of the units, spare units, and/or spare parts as required, at contractor's expense.

d. "Pipeline" unit spares as needed by the Government on a consignment (no-charge loan) basis but no greater than that provided by the following formula:

$$n = (A \times S) - Sp \text{ (rounded to next highest whole number)}$$

* NOTE: Measurement periods should be tailored to program requirements.

where

n = maximum number of consignment spare units

Sp = quantity of units previously loaned to and retained on a loan basis by the Government

A = calculated number defined as follows:

$A = \frac{G}{M} - 1$ (if greater than 1.0, A shall be redefined to be equal to 1.0)

G = guaranteed MTBF value for the unit for the measurement period

M = measured unit MTBF

S = a "target" spares level based on the percentage of the average number of installed sets over the six-month measurement period. This average number ($\bar{N}$) is defined in Part V, Paragraph 11. S is defined to be equal to:

$$S = \bar{N}\left(\frac{OST + T_r}{G}\right)(AOT) + 1.65\sqrt{\bar{N}\left(\frac{OST + T_r}{G}\right)(AOT)}$$

where

OST = average number of pipeline days to and from contractor's facility

T_r = required contractor turnaround time

AOT = estimated average operating time per installed unit per day

If n is negative for a particular type of unit, the provisions of Part V, Paragraph 8, concerning return of consignment units shall apply.

6. The objectives of consignment units is to support the warranty pipeline flow pending improvement of the MTBF in the non-conforming sets/units. The contracting officer, after investigating spares availability, contractor turnaround-time performance, and contractor actions and plans for MTBF improvement, will determine the actual number of consignment spares to be provided by the contractor in the event a guaranteed unit MTBF value is not achieved; but in no event shall such actual number exceed that provided by the formula in Part V, Paragraph 5 (d) thereof.

7. In the event additional consignment units are to be supplied by the contractor to the Government, the contractor shall ship such units to the Government as soon as reasonably possible but no later than sixty (60) days after the Government notifies the contractor of the number of consignment units required if the contractor is currently producing such units, or no longer than two hundred forty (240)* days after notification if the units are not currently in production. For each consignment unit not supplied

* NOTE: Function of production leadtime.

within the appropriate period, the contractor will be assessed liquidated damages at the rate of (three and one-third percent* (3 1/3%)) of the most recent unit price on this contract for each day late in accordance with paragraph (f) of the Default clause. In no event, however, shall the liquidated damages associated with any specific MTBF measurement period for any individual unit be more than 50 percent of the most recent price for such a unit. The "most recent price" is defined as the most recent production price as it has been revised to reflect any equitable adjustment thereto. In addition, Sp in the equation of Paragraph 5 (d) shall be increased by the amount of liquidated damages (in terms of percent of unit contract price) for each unit for which liquidated damages are paid.

* **Must be determined on a case by case basis.**

8. In the event units have been consigned to the Government and n as calculated in Paragraph 5 (d) hereto is negative, all or a portion of such consignment units will be returned to the contractor according to the following formula:

Number of consignment units to be returned =

$$S_C - \left(\frac{G}{M} - 1\right) \times S$$

where

S_C = number of hardware units currently on consignment

G, M, S are as defined in Paragraph 5 (d)

9. The Government will return the number of consigned units determined in Paragraph 8 as soon as possible but no later than sixty (60) days after an MTBF measurement indicates that such return is required. The units returned shall be operable and shall be either the actual units provided by the contractor or equivalent units provided under this contract. In the event that such units are not shipped to the contractor within sixty (60) days, the Government shall pay the contractor an amount equal to (three and one-third* percent (3 1/3%)) of the latest unit price on this contract for each day exceeding sixty (60) days, up to a maximum of the most recent unit price on this contract. The "most recent unit price" is defined as the "most recent production price as it has been revised to reflect any equitable adjustment thereto." Excess consignment units not shipped by the Government within ninety (90) days shall become the property of the Government upon full payment of the amounts specified in this paragraph.

* **Must be determined on a case by case basis.**

10. All units still on consignment to the Government after the MTBF guarantee provision terminates, shall become the property of the Government at no additional cost to the Government unless an extension of the MTBF provision is negotiated. Consignment units which are in the Government inventory, or which become the property of the Government through (1) the provisions of paragraph 9 of Part V or (2) through the situation described above in this paragraph shall be subjected to all provisions of the reliability improvement warranty and MTBF guarantee clause of this contract as appropriate at no increase in contract price. The warranty expiration date for such units shall coincide with the latest warranty expiration date existing on the contract for the unit type involved.

11. This paragraph provides the method for measuring achieved operational MTBF over the six-month measurement period.

a. For each unit type achieved MTBF is defined as follows:

$$MTBF_i = \frac{TOH}{F_i}$$

where

$MTBF_i$ = achieved MTBF of the i^{th} type unit

TOH = total operating hours of the set population over the measurement period

F_i = number of relevant verified failures of the i^{th} type unit occurring during the measurement period

b. It shall be assumed that average operating time per day (AOT) for each type of installed unit is the same. This statistic, which is to be used to estimate TOH, shall be calculated from elapsed-time-indicator (ETI) readings of units returned to the contractor for warranty action.

c. An estimate of average operating time per day for all installed sets shall be made as follows:

$$\text{Average operating time per day} = \frac{\text{Total elapsed operating hours of all units returned during the six-month measurement period}}{\text{Total installed days of all units returned during the six-month measurement period}}$$

The elapsed operating hours of a unit returned during the measurement period is defined to be the ETI reading of the unit when received by the contractor minus the ETI reading of the unit when last shipped by the contractor. The number of installed days of a unit returned during the measurement period is defined as the total number of days the unit was installed in an aircraft starting with the date the unit was last shipped to a Government installation to the date the unit is received by the contractor. It is noted that the values in the numerator and denominator of the above equation must be based on the same units. If all required data are not available for a returned unit, then that returned unit shall be excluded from the calculation of AOT.

d. The average number of set installations over the six-month measurement period shall be calculated from Air Force-supplied data as follows:

$$\bar{N} = \frac{1}{6} \sum_{j=1}^{6} N_j$$

where

N_j = *number of aircraft that contain an installed set on the last day of the* j^{th} *month of the six-month measurement period.*

e. Total operating hours for the i^{th} *unit over the six-month period is then calculated as follows:*

$$TOH_i = D \times \bar{N} \times AOT \times Q_i$$

where

D = *number of days in the six month period*

Q_i = *the average number of units of the* i^{th} *type installed in an aircraft.*

End of Sample

Appendix D

Award Fee Provisions

Because award fee provisions must be tailored to the item or equipment selected, standard award fee clauses are not feasible. However, this appendix contains two sample provisions for information and guidance only. The first addresses a payment provision based to a large degree on the contractor's accomplishments in minimizing logistics support costs. The second addresses a fee based on the results of life cycle cost and design to cost trade studies.

1. Logistics Support Cost Award Fee Provision

Incentive Award (Payment Provisions)

1. In addition to the amounts specified elsewhere in this contract, an award fee for superior accomplishment in minimizing logistic support costs may be applicable at the Government's option. The maximum amount payable hereunder is $____________.

2. The contractor's performance in minimizing adverse logistics support costs will be continuously monitored by the Fee Evaluation Board (FEB). The FEB's criteria for determining the amount of the award fee to dispense (if any) shall take the following into consideration:

a. Analysis of differences between the Target Logistics Support Costs and the Measured Logistics Support Costs for the validation period.

b. Logistics management and planning for initial maintenance at all levels, supply and support equipment for each phase.

c. Management of training requirements.

d. Management of Tech Manual program to include validation/verification accomplishments to support delivered aircraft.

e. Management and accomplishment of test programs that verify logistics support requirements.

3. Special Factors

a. Payment or nonpayment of any fee awarded to the contractor hereunder shall not be subject to the provision of the clauses in this contract entitled "Termination," "Limitation of Government Obligation," and "Allowable Cost, Incentive Fee, and Payment."

b. Any decision of the FEB with respect to awards to the contractor hereunder shall not be subject to the clause hereof entitled "Disputes." An award fee plan will be prepared by the SPO and distributed to the contractor and interested Government agencies within six months after contract award. This plan will outline in detail schedules and criteria for implementing this provision of the contract. The Government reserves the right to change the criteria as listed in paragraph b above, with advance notification to the contractor.

c. The contractor will be given the opportunity to brief the Fee Evaluation Board on his assessment of accomplishment attained during the defined evaluation periods.

End of Sample

2. LCC/DTC Trade Study Award Fee

Award Fee

1. In addition to the profit specific elsewhere in this contract, an award fee will be payable by the Government. The maximum amount payable under this provision is $______________. An initial award fee will be based primarily on the air vehicle design cost reduction and opportunities guidance developed by the LCC/DTC design trade studies conducted prior to CDR. A second award fee will be based primarily on the supportability including SE, training and maintenance, design, cost reduction opportunities guidance developed by the LCC/DTC design trade studies prior to flight of the first DT&E aircraft.

2. Up to $______________ may be awarded at the completion of the Critical Design Review (CDR) based on the criteria set forth in 4 below.

3. The contractor's performance in accomplishing LCC/DTC objectives shall be continuously monitored by the Fee Evaluation Board chaired by ____________________________ or his designee and such other members as he may designate.

4. The evaluation of the contractor's performance will be based upon the following criteria:

(These criteria will be negotiated during source selection based upon the plan submitted by the contractor for accomplishing cost trade studies.)

5. Payment of any award fee awarded to the contractor thereunder shall not be subject to the provisions of the clauses entitled "Limitation of Government Obligation" and "Incentive Price Revision (Firm Target)."

6. Any decision of the Fee Evaluation Board with respect to awards to the contractor hereunder shall not be subject to the "Disputes" clause.

End of Sample

Appendix E

References

1. AFR 57-1
Required Operational Capabilities

2. AFP 70-1-5
DOD Incentive Contracting Guide

3. AFM 70-6
Source Selection Procedures

4. AFR 70-15
Source Selection Policy

5. AFR 80-5
Reliability and Maintainability Programs for Systems, Subsystems, Equipment and Munitions

6. AFR 80-14
Test and Evaluation

7. AFR 173-10
USAF Cost and Planning Factors

8. AFR 178-1
Economic Analysis and Program Evaluation for Resource Management

9. AFR 800-2
Program Management

10. AFR 800-3
Engineering for Defense Systems

11. AFR 800-8
Integrated Logistics Support (ILS) Program for Systems and Equipment Programs and Projects

12. AFR 800-11
Life Cycle Costing

13. AFR 800-17
Work Breakdown Structures

14. AFSCP 70-4
Request for Proposal Preparation Guide

15. AFSCR 70-7
AFSC Procurement Evaluation Panel

16. AFSCR 70-9
Source Selection Procedures

17. AFSCP 800-3
A Guide for Program Management

18. AFSCP 800-6
Statement of Work Preparation Guide

19. AFSCP 800-15
Contractor Cost Data Reporting (CCDR) System

20. AFSCR 800-18
Joint Operational and Technical Review (JOTR)

21. AFSCP/AFLCP 800-19
Joint Logistics Commanders Guide on Design to Cost

22. AFSCP-800-23
Secretary of the Air Firce Program Review/Program Assessment Review/Command Assessment Review (SPR/PAR/CAR)

23. DOD Directive 5000.1
Acquisition of Major Defense Systems (AFR 800-2, Atch 3)

24. DOD Directive 5000.2
The Decision Coordinating Paper (DCP) and the Defense Systems Acquisition Review Council (DSARC) (AFR 800-2, Atch 4)

25. DOD Directive 5000.26
Defense Systems Acquisition Review Council (DSARC) (AFR 800-2, Atch 5)

26. DOD Directive 5000.28
Design to Cost

27. DOD Manual 7110.1-M
Department of Defense Budget Guidance Manual

28. ASPM-1
Armed Services Procurement Regulation Manual for Contract Pricing

29. LCC-1
DOD Life Cycle Costing Procurement Guide (Interim)

30. LCC-2
DOD Casebook Life Cycle Costing in Equipment Procurement

31. LCC-3
DOD Life Cycle Costing Guide for Systems Acquisitions (Interim)

32. RIW Interim Guideline

This document is one of a series prepared to assist Air Force personnel understand and apply life cycle costing techniques. Other documents in this series include:

Life Cycle Cost Plan Preparation Guidance, October 1975

Understanding and Evaluating Life Cycle Cost Models, October 1975

Life Cycle Cost Analysis Guide, November 1975

Supplemental Life Cycle Costing Program Management Guidance, January 1976

Analysis of Available Life Cycle Cost Models and Their Applications, July 1976

Copies of all of these documents are available from ASD/ACL, WPAFB, Ohio 45433.